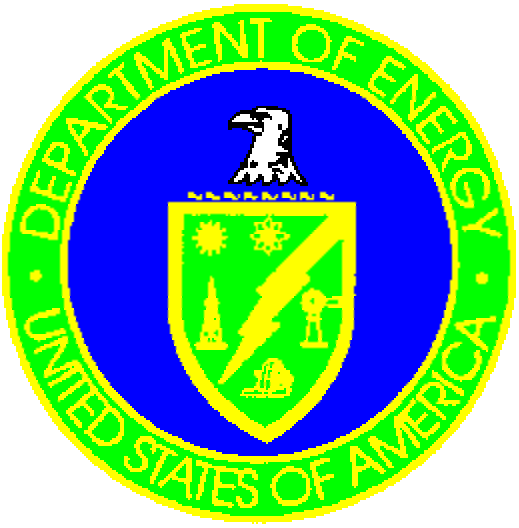
DOE/WIPP 00-2014, Rev. 0

WIPP Sampling and Analysis Plan for Solid Waste Management Units and Areas of Concern

May 2000

Waste Isolation Pilot Plant
Carlsbad, New Mexico



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ACRONYMS AND ABBREVIATIONS

ACAA	Accelerated Corrective Action Approach
AOC	Area of Concern
BLM	Bureau of Land Management
CFR	*Code of Federal Regulations*
CMI	Corrective Measure Implementation
CMS	Corrective Measures Study
DOE	U.S. Department of Energy
DQO	Data Quality Objective
DSP	Duval Sulphur & Potash Company
EPA	U.S. Environmental Protection Agency
ES&H	Environment, Safety, and Health (Department)
HSWA	Hazardous and Solid Waste Amendments
HWDU	Hazardous Waste Disposal Unit
ICP-MS	Inductively Coupled Plasma – Mass Spectroscopy
IDW	Investigation Derived Waste
IMC	International Minerals & Chemical Corporation
LWA	Land Withdrawal Act
MDL	Method Detection Limit
MRL	Method Reporting Limit
NFA	No Further Action
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMOCC	New Mexico Oil Conservation Commission
PPE	personal protective equipment
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation

SAP	Sampling and Analysis Plan
SARM	Standard Analytical Reference Material
SOP	Standard Operating Procedure
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
TSD	Technical Support Document
USGS	United States Geological Survey
UTL	Upper Tolerance Limit
VRA	Voluntary Release Assessment
WID	Waste Isolation Division
WLWA	WIPP Land Withdrawal Area
WIPP	Waste Isolation Pilot Plant

DEFINITIONS

Area of Concern (AOC)[1]- Any discernable unit or area which, in the opinion of the New Mexico Environment Department (NMED) Secretary, may have received solid or hazardous waste or waste containing hazardous constituents at any time.

Direct Push Methodology - Truck-mounted soil sampling device. Soil is collected in a stainless steel cylinder that is pushed through soil to the desired depth using a hydraulic ram.

Hazardous Constituent[1] - Any constituent identified in 20 NMAC [New Mexico Administrative Code] 4.1.200 (incorporating Title 40 *Code of Federal Regulations* (CFR) § 261 Appendix VIII), any constituent identified in 20 NMAC 4.1.500 (incorporating 40 CFR § 264 Appendix IX), any constituent identified in a hazardous waste listed in 20 NMAC 4.1.200 (incorporating 40 CFR § 261 Subpart D), or any constituent identified in a toxicity characteristic waste in 20 NMAC 4.1.200 (incorporating 40 CFR § 264.24, Table 1).

Hazardous Waste[1] - A solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or notably contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HSWA[1] - The 1984 Hazardous and Solid Waste Amendments to RCRA

LWA - WIPP Land Withdrawal Act (Public Law 102-579) transferred the jurisdiction for the WIPP Land Withdrawal Area (WLWA) from the United States Secretary of the Interior to the United States Secretary of Energy. These lands "are withdrawn from all forms of entry, appropriation, and disposal under the public land laws" and are reserved for the use of the Secretary of Energy "for the construction, experimentation, operation, repair and maintenance, disposal, shutdown, monitoring, decommissioning, and other authorized activities, associated with the purposes of WIPP."

Permit - WIPP Hazardous Waste Permit NM4890139088-TSDF

Permittees - U.S. Department of Energy (DOE) and co-operator personnel

RCRA[1] - The Resource Conservation and Recovery Act of 1980 as amended by HSWA in 1984.

[1]These definitions were extracted directly from the October 27, 1999, Waste Isolation Pilot Plant Hazardous Waste Permit.

Release[1] - Any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping, or disposing of hazardous wastes (including hazardous constituents) into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing hazardous wastes or hazardous constituents).

Solid Waste Management[1] - The systematic administration of activities which provide for the collection, source separation, storage, transportation, transfer, processing, treatment, and disposal of solid waste.

Solid Waste Management Unit (SWMU)[1] - Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released. The definition includes regulated units (i.e., landfills, surface impoundments, waste piles, and land treatment units), but does not include passive leakage or one-time spills from production areas and units in which wastes have not been managed (e.g., product storage areas).

WLWA - The WIPP Land Withdrawal Area is the 16-section federal land area, delineated by the WIPP site boundary, under the jurisdiction of the DOE. This area is located in Eddy County, New Mexico, approximately 30 miles east of Carlsbad, New Mexico.

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared to fulfill requirements of Module VII, Section VII.M.2 and Table VII.1, requirement 4 of the Waste Isolation Pilot Plant (WIPP) Hazardous Waste Permit, NM4890139088-TSDF (the Permit); (NMED [New Mexico Environment Department], 1999a). This SAP describes the approach for investigation of the Solid Waste Management Units (SWMU) and Areas of Concern (AOC) specified in the Permit.

This SAP addresses the current Permit requirements for a RCRA Facility Investigation (RFI) investigation of SWMUs and AOCs. It uses the results of previous investigations performed at WIPP and expands the investigations as required by the Permit. As an alternative to the RFI specified in Module VII of the Permit, current NMED guidance identifies an Accelerated Corrective Action Approach (ACAA) that may be used for any SWMU or AOC (NMED, 1998). This accelerated approach is used to replace the standard RFI work plan and report sequence with a more flexible decision-making approach. The ACAA process allows a facility to exit the schedule of compliance contained in the facility's Hazardous and Solid Waste Amendments (HSWA) permit module and proceed on an accelerated time frame. Thus, the ACAA process can be entered either before or after a RFI work plan. According to NMED's guidance, a facility can prepare a RFI work plan or SAP for any SWMU or AOC (NMED, 1998).

The Westinghouse Government Environmental Services Company, LLC, Waste Isolation Division (WID) is the co-operator of the WIPP hazardous waste facility. For the purposes of this SAP, references to WIPP personnel include both U.S. Department of Energy (DOE) and co-operator personnel (Permittees). NMED provided guidance to DOE and WID regarding substitution of a SAP for an RFI Work Plan. In a certified letter to DOE and WID, dated April 20, 2000, NMED approved submittal of a SAP in lieu of a RFI Work Plan.

1.1 Objectives and Scope

The purpose of the investigations described in this SAP is to comply with requirements of the Permit regarding investigation of the SWMUs. The objective of this SAP is to define the extent of concentrations of hazardous constituents that exceed background metal concentrations in soil at specific SWMUs. The scope of this investigation is limited to the SWMUs identified in the Permit.

1.2 Approach and Implementation

This SAP describes the approach and implementation for investigations to be conducted at the SWMUs identified in the permit. The approach will include collection and analysis of environmental samples with subsequent data analysis, interpretation and reporting. For implementation, field investigations will be conducted at selected SWMUs to collect subsurface soil samples for chemical analysis to identify the extent of hazardous

constituents above background. The analytical results will be tabulated and reviewed to assess whether additional investigative activities or corrective actions are warranted at the sites investigated. For the AOCs, no samples will be collected. The mud pit AOCs have been closed under another regulatory authority as described later in this document. For the two sumps (AOCs 010b and 010c), there is no pathway for hazardous constituents to human or environmental receptors as described in sections 23.0 and 24.0 of this document.

1.3 Background Issues

The WIPP is an industrial facility that consists of 16 square miles of land surface, surface buildings and structures, an underground network of subsurface excavated openings, and vertical shafts, which connect the surface and subsurface areas. Waste, equipment, and personnel enter the underground facility through designated shafts. The facility operational period is estimated to be 35 years with a 30-year postclosure care period. Active institutional controls will be maintained postclosure for 100 years.

The underground hazardous waste disposal units (HWDUs) defined as waste panels, are located 2,150 feet (655 meters) below ground surface, in the WIPP underground. The waste panels consist of seven rooms and two access drifts each. Each room is approximately 300 feet (91 meters) long, 33 feet (10 meters) wide, and 13 feet (4 meters) high. Access drifts connect the rooms and have the same cross section. The HWDUs are not addressed in this SAP.

Samples were collected at some of the SWMUs as part of a RCRA Facility Assessment (RFA) performed by NMED (NMED/DOE/AIP 94/1, 1994). WIPP conducted two rounds of soil sampling at selected SWMUs in 1995 and 1996. In the summer of 1995 soil samples were collected for initial characterization by the toxicity characteristic leaching procedure (TCLP). A second round of sampling at the same SWMUs was conducted in the summer of 1996 and involved the collection of soil samples for total constituent analyses. The total constituent analysis data were collected based on a request from NMED to support the TCLP metals data collected in the initial sampling round.

The NMED reviewed the sampling conducted by WIPP at the SWMUs and defined a list of SWMUs with constituents of concern and AOCs to be included in the Permit. These SWMUs/AOCs and constituents of concern for the SWMUs were described in the *Technical Support Document, Exclusion/Inclusion of Solid Waste Management Units and Areas of Concern, Permit Module VII Correction Action for Solid Waste Management Units* (TSD) (NMED, 1999b).

1.3.1 Regulatory Requirements

The Permit identifies 15 SWMUs requiring an RFI, 3 SWMUs not requiring an RFI (the Hazardous Waste Material Units), and 8 AOCs in the 16-section WIPP Land Withdrawal Area (WLWA). The WIPP Land Withdrawal Act (Public Law 102-579) created the WLWA in October 1992. This Act transferred the jurisdiction of the WLWA from the Secretary of the Interior to the Secretary of Energy. In accordance with sections 3(a)(1) and (3) of the Act, these lands " . . . are withdrawn from all forms of entry, appropriation, and disposal under the public land laws . . . " and are reserved for the use of the Secretary of Energy " . . . for the construction, experimentation, operation, repair and maintenance, disposal, shutdown, monitoring, decommissioning, and other authorized activities, associated with the purposes of WIPP as set forth in section 213 of the Department of Energy National Security and Military Applications of Nuclear Energy Act of 1980 (Public Law 96-164; 93 Statute 1259, 1265) and this Act."

The SWMU program at WIPP began in 1994 under U.S. Environmental Protection Agency (EPA) regulatory authority. NMED subsequently received regulatory authority from EPA. A Phase I RFI was completed at WIPP during 1996 as part of a Voluntary Release Assessment (VRA).

Some of the SWMUs and AOCs were identified in the original RCRA Part B Permit Application for the facility (Revision 0, DOE/WIPP 91-005), and were included in an RFA performed by the NMED (NMED/DOE/AIP 94/1, 1994). The 15 SWMUs and 8 AOCs identified in the Permit are associated with: (1) natural resource exploration activities prior to the development of the WIPP, (2) early WIPP mineral assessment and geological studies to support the development of the facility, or (3) facility construction.

1.3.1.1 Solid Waste Management Units

The 15 SWMUs included in the Permit that require an RFI are:

- SWMU 001g (H-14/P-1 mud pits)**
- SWMU 001h (H-15/P-2 mud pits)**
- SWMU 001j (P-3 mud pit)**
- SWMU 001k (P-4 mud pit)**
- SWMU 001L (WIPP-12 drilling mud pit/P-5 drilling mud pit**)
- SWMU 001m (P-6 mud pit)**
- SWMU 001n (P-15 mud pit)**
- SWMU 001o (Badger Unit drilling mud pits)**
- SWMU 001p (Cotton Baby drilling mud pits)**
- SWMU 001q (DOE-1 drilling mud pits)
- SWMU 001s (ERDA-9 mud pit)**
- SWMU 001t (IMC-374 mud pit)**
- SWMU 001x (WIPP-13 drilling mud pits)

- SWMU 004a (Portacamp Storage Yard, West Side)
- SWMU 007b (SW Evaporation Pond)

** Soil sampling will not be conducted at these SWMUs under this SAP.

1.3.1.2 Areas of Concern

The eight AOCs included in the Permit are:

- AOC 001r (D-123 mud pit)**
- AOC 001u (IMC-376 mud pit)**
- AOC 001v (IMC-456 mud pit)**
- AOC 001w (IMC-457 mud pit)**
- AOC 001ac (DSP-207 mud pit)**
- AOC 001ae (IMC-377 mud pit)**
- AOC 010b (Waste Handling Shaft sump)**
- AOC 010c (Exhaust Shaft sump)**

** Soil sampling will not be conducted at these AOCs under this SAP.

1.3.2 Other Issues

This SAP addresses the current Permit requirements for investigations at the SWMUs and AOCs. It uses the results of previous investigations performed at WIPP and expands the investigations as required by the Permit.

The Permittees believe that the results of the field investigations and other documentation will lead to a request for No Further Action (NFA) for all SWMUs and AOCs specified in the permit. Approval of the NFA request by NMED will allow the Permittees to request a permit modification to exit the RFI/Corrective Measures process, and remove the SWMUs and AOCs from the Permit.

Currently, NMED, DOE, and WID believe that a number of the mud pit SWMUs and all of the AOC mud pits should be considered to have been closed under another regulatory authority. The documentation for closure of these SWMUs and AOCS will be provided to the NMED as part of the NFA request. If the NMED approves the NFA request, these SWMUs and AOCs will be removed from the Permit.

1.3.2.1 Background and Action Levels for Evaluation of Analytical Results

Because metals are included in the list of target analytes for the SAP investigations, establishing site background concentrations is important to assess the potential impact of the SWMU sites on the surrounding environment. Soil samples were collected outside of the SWMU at each SWMU site sampled. These data constitute background information

and are included in the discussions of analytical results for each SWMU presented in subsequent chapters of this report. WIPP pooled the background sample analysis results to better assess general background metals concentrations across the WIPP site. Information regarding site background concentrations is presented in Appendix A to allow review of the background data sets and the statistical analyses performed.

1.3.2.2 Thallium Concentration Data

In the TSD, NMED included five SWMUs for further investigation, because of elevated analytical reporting for thallium. During September 1999, WIPP personnel collected additional subsurface soil samples at these SWMUs and submitted the samples for analysis of thallium concentrations. As described in Appendix B, there were no detections of thallium in any of the potential source material at the SWMUs. Consequently, WIPP has eliminated thallium as a constituent of concern for the investigations described in this SAP.

1.4 Data Quality Objectives Process

The Data Quality Objectives (DQO) process has been implemented to tailor data gathering strategies for the purpose of making corrective action decisions (EPA, 1987, 1993, 1994b, 1998a). The DQO process is used to ensure that environmental data are adequate, scientifically valid, defensible, and of an appropriate level of quality, given the intended use for the data in corrective action decision making. The DQO process involves a seven part planning effort as shown in Figure 1.1. DQOs define sampling program objectives and specify the underlying hypotheses so that appropriate data are collected and defensible conclusions can be drawn from the data. Each of the seven DQO elements is summarized in the following subsections.

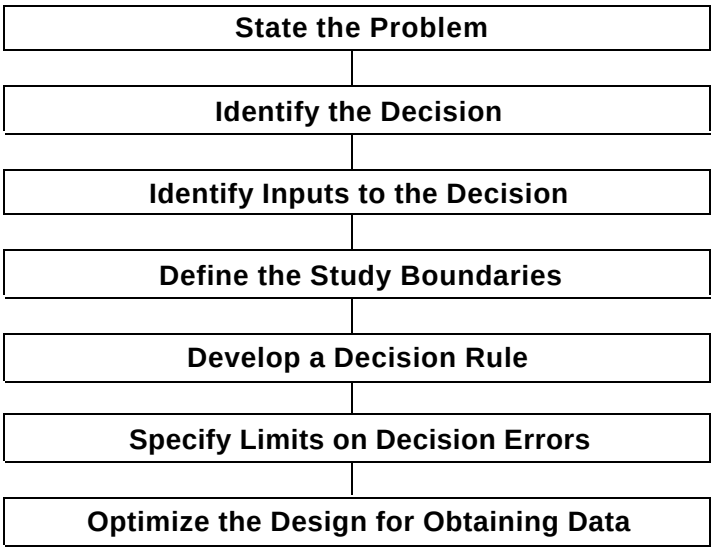

Figure 1.1 - Data Quality Objectives Process

1.4.1 State the Problem

The first step in the DQO process is to state the problem. For this SAP, the problem is to identify if there has been a release and, if so, the extent of the release.

1.4.2 Identify the Decision

The second step of the DQO process is to identify the decision for the investigations. Decisions need to be made for each SWMU to be investigated under this SAP. The decision to be made for each SWMU is whether the average metal concentrations in soil exceed the EPA Region VI industrial screening criteria (EPA, 1999). If the average metal concentrations exceed industrial screening criteria, the risk will be explicitly evaluated. If the average metal concentration is less than the EPA Region VI industrial screening criteria, the decision will be to request NFA status for the SWMUs. The AOCs have already been closed under another regulatory authority and will not be investigated.

1.4.3 Identify Inputs to the Decision

As the third step in the DQO process, inputs to the decision include technical and regulatory elements that will be developed and utilized during the investigation. These elements include the locations where soil samples will be collected, local and regional concentrations of metals in background soil, analytical results from the analyses of the samples collected from the site and EPA Region VI industrial screening levels.

1.4.4 Define the Study Boundaries

The fourth step in the DQO process is to define the study boundaries. For this investigation, the study boundaries are initially defined by the approximate physical dimensions of the SWMUs. The investigations will be restricted to the SWMUs identified in the Permit within the 16-section WLWA, and that have not been closed under another regulatory authority. Horizontal boundaries for the SWMUs will be the currently identified horizontal dimensions of the SWMUs and AOCs and an additional five to ten feet in each direction. Vertical boundaries are defined as the approximate vertical dimensions of the SWMU soil material and will include soil one to two feet below the SWMU soil material.

1.4.5 Develop a Decision Rule

Step five of the DQO process is to develop a decision rule. To develop a decision rule, a parameter to characterize the population of interest must be defined. For this investigation of the SWMUs, if the horizontal and vertical dimensions of the concentrations above background have been defined within 50 percent and the average concentrations of the constituents (barium, chromium, lead, nickel or methanol as appropriate) are less than the respective EPA Region VI screening criteria, then the results will be documented and a

NFA request will be submitted. If the constituent concentrations exceed EPA Region VI screening criteria then human health risk will be evaluated.

1.4.6 Specify Limits on Decision Errors

In step six of the DQO process, the limits on decision errors are specified. Defining the acceptable decision error rate is based on a consideration of the consequences of making an incorrect decision. For this investigation of SWMUs, decision errors are limited to those associated with the simple comparison of constituent concentrations to screening criteria. For the investigation of the SWMUs, if the maximum measured constituent concentrations are below the EPA Region VI industrial screening criteria, the average concentrations will also be below the screening criteria and no other statistical evaluations will be necessary. The use of industrial screening criteria is appropriate because no future residential use of the WIPP site is planned. For the SWMUs, the dimensions of the horizontal and vertical extent of elevated constituent concentrations will be estimated to within 50 percent based on previous collected data and data gathered under this SAP.

1.4.7 Optimize the Design for Obtaining Data

The final step of the DQO process is to optimize the study design. Optimization of the sampling design helps to identify the most effective sampling design that generates data which satisfies the DQOs specified in the preceding steps. The stratified random sampling design developed for investigation of the SWMUs will satisfy the DQOs and is resource effective. Details of the sampling program are presented in the following sections for each SWMU.

1.5 Sampling and Analysis Plan Organization

This SAP follows the outline provided by NMED in their guidance document (NMED, 1998). Sections 2.0 through 24.0 of this SAP address the15 SWMUs and 8 AOCs included in the Permit. Based on the SAP outline, the organization of section 2 is repeated in section 3 through 24. Each of these sections include discussion of the characterization and setting, existing site data, current understanding of nature and extent of contamination, fate and transport, and proposed sampling activities for an individual SWMU or AOC. Subsections that are not applicable for a particular SWMU or AOC are identified in the text. Section 25.0 describes data collection design and procedures, section 26.0 describes project management, and section 27.0 is a summary.

2.0 SWMU 001g (H-14/P-1 MUD PITS)

The following subsections discuss the characterization and setting and field investigation activities that have been conducted at SWMU 001g.

2.1 Characterization and Setting

SWMU 001g is located in the southwest (SW) ¼ of the SW ¼ of the SW ¼ of Section 29, Township 22 South, Range 31 east (Figure 2.1). Two boreholes were drilled at this location (P-1 and H-14). SWMU 001g consists of the mud pits constructed for the drilling of the P-1 potash exploration well and the H-14 Culebra test well.

2.1.1 Site Description

The drill pad where the P-1 and H-14 boreholes are located has been extensively graded and regraded. The H-14 well site has been used as a monitoring well since it was drilled in 1986. The H-14 mud pit is located on the north side of the drill pad area adjacent to the H-14 borehole. The H-14 mud pit measures approximately 30 feet wide and 100 feet long. The area of the mud pit is delineated by disturbed soil covered with rock fragments.

The P-1 mud pit is located in the middle of the SWMU 001g drill pad. The mud pit area is approximately 25 feet wide and 37 feet long. The mud pit area is identified by a slightly discolored, sunken area 50 feet south of the H-14 borehole and adjacent to the P-1 borehole.

2.1.2 Operational History

The P-1 potash exploration borehole was drilled by the Pennsylvania Drilling Company in August, 1976 as part of a 21-well United States Geological Survey (USGS) resource evaluation program to investigate the potash resources in the Salado Formation. The total depth of the P-1 borehole was 1,591 feet. The site was closed by the USGS in 1976.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed

substantially since that time, as evidenced by recent permits being granted by the Bureau of Land Management (BLM).

The H-14 borehole was drilled in October 1986 to provide a Culebra-dolomite monitoring well in the southwest quadrant of the WIPP site. The H-14 monitoring well was drilled to a total depth of 589 feet. The H-14 well was originally drilled using a 7.85-inch rock bit to a depth of 533 feet, 12 feet above the Culebra Formation. The original borehole was hydrologically tested in the Dewey Lake and Rustler Formations. A 5.5-inch casing was set in the hole and cemented to the surface. A 4.5-inch hole was then cored through the cement and then continued to a depth of 574 feet. After a series of drill stem tests in the Culebra Formation, the borehole was reamed to 4.75 inches and deepened to a final depth of 589 feet.

2.1.3 Waste Characterization

Salt mud water and brine were used to complete the P-1 borehole. Drilling fluids that were used to complete the H-14 borehole include brine and fresh water. A mixture of saturated sodium and potassium chloride brine, starch and salt gel, and attapulgite was used to reduce the degree of dissolution of the Salado Formation during drilling operations for P-1. An organic tracer (meta-trifluorobenzoic acid 10 mg/l) was added to freshwater at H-14 to measure contamination of the Culebra Formation resulting from the drilling process. Approximately 4,260 gallons of traced drilling fluid were lost during the drilling representing about 80 to 90 percent of the recirculated drilling fluid.

2.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

2.2.1 Existing Data

The following subsections describe data that were collected for SWMU 001g.

2.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

2.2.1.2 Sampling

During a summer 1995 sampling event, 24 soil samples and 4 associated quality assurance/quality control (QA/QC) samples were collected to characterize the vertical and horizontal extent of any potential release from the SWMU 001g. The WIPP collected 12 soil-boring samples from the P-1 mud pit area and 12 soil boring samples from the H-14 site for TCLP metals analysis.

The SWMU 001g soil sampling locations were sampled again in the summer of 1996. During the summer 1996 sampling event, 20 soil boring samples and 4 associated QA/QC samples were collected for total constituent analysis to further characterize the vertical and horizontal extent of any potential release of hazardous constituents from the SWMU 001g mud pit.

The rationale for selecting sample depths at mud pits during the previous sampling was based on an evaluation of the SWMU 001g site, and historical information contained in the RFA. Samples collected and submitted for metals analysis in the mud pit area at the 12- to 24-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 60- to 72-inch depth were used to evaluate the maximum vertical extent of potential constituent migration. Figure 2.1 is a site map showing sample locations and lead concentrations at the sample locations for SWMU 001g.

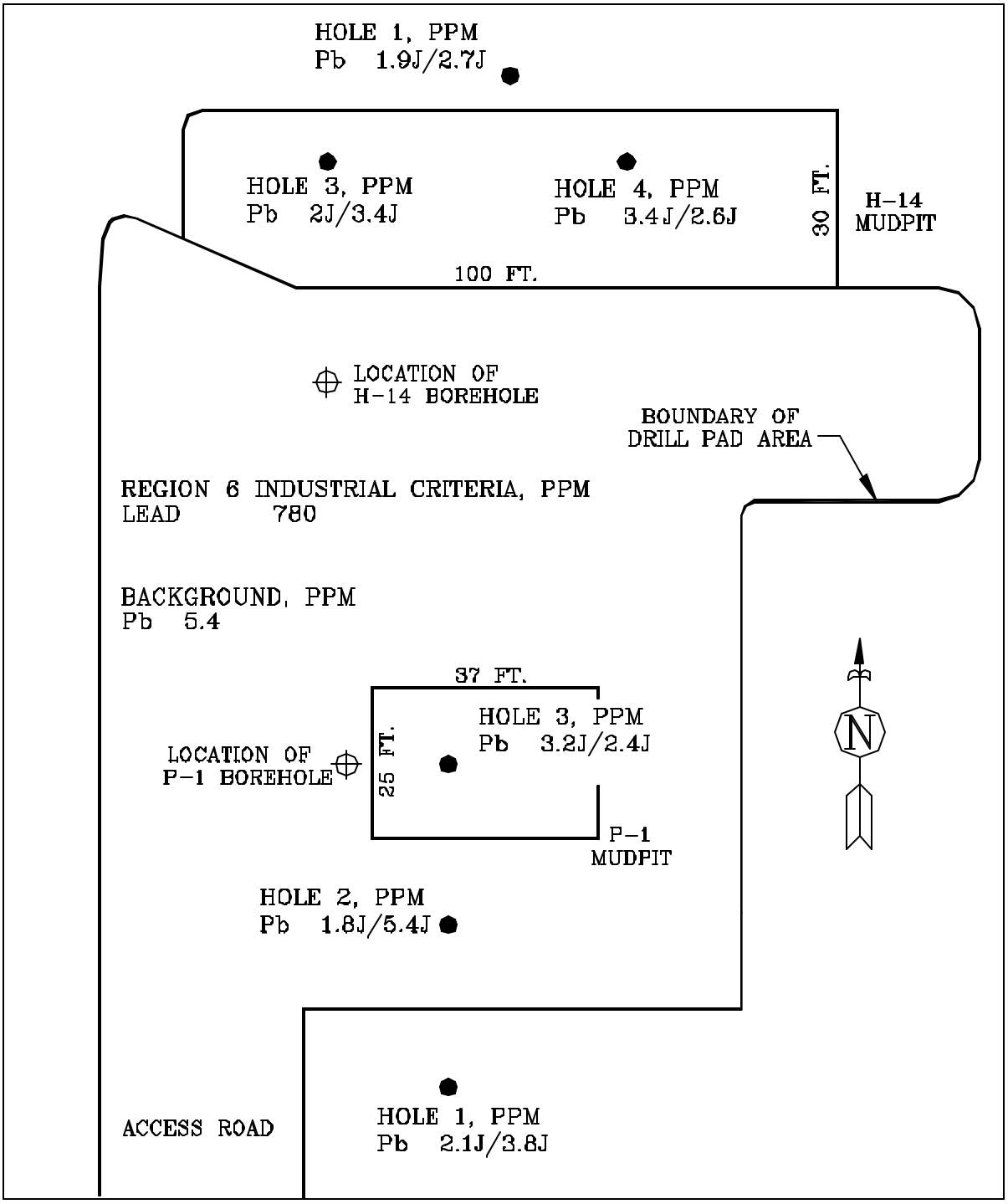

Figure 2.1 - Sample Location Map – SWMU 001g (H-14 & P-1)

2.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

2.2.2.1 Nature and Extent of Contamination

The TSD identified lead and thallium as potential constituents of concern for the mud pit materials in this SWMU. Concentrations of lead were detected at SWMU 001g by total metals analyses (Table 2.1).

Table 2.1
Summary of Measured Concentrations for Constituents of Concern
SWMU 001g (H-14 & P-1)

Description	Hole #	Depth (in.) (in. bgs)	Constituent	Concentration (ppm)	Qualifier
H-14 Mud Pit	1	12 to 24	Lead	1.9	J
		60 to 72	Lead	2.7	J
	3	12 to 24	Lead	2	J
		60 to 72	Lead	3.4	J
	4	12 to 24	Lead	3.4	J
		60 to 72	Lead	2.6	J
P-1 Mud Pit	1	12 to 24	Lead	2.1	J
		60 to 72	Lead	3.8	J
	2	12 to 24	Lead	1.8	J
		60 to 72	Lead	5.4	J
	3	12 to 24	Lead	3.2	J
		60 to 72	Lead	2.4	J

Notes:
Background concentration for lead = 5.4 ppm
ppm = parts per million
in. bgs = inches below ground surface.
J = Result should be considered an estimated value.
SWMU = Solid Waste Management Unit

Total metals concentrations of lead measured in SWMU 001g are below the lead background concentration (Table 2.1 and Appendix A). In addition, as defined in Appendix B, thallium has been eliminated as a constituent of concern for the SWMUs. Based on the information contained in Table 2.1, Appendix A, and Appendix B, there has been no release of hazardous constituents at this SWMU. In addition, P-1 was closed by the USGS in 1976. Consequently, no additional investigations will be conducted at this SWMU.

2.2.2.2 Fate and Transport

As stated above, available data indicate that no hazardous constituents exist in SWMU 001g above background. Further, no release of hazardous constituents has occurred. Table 4 of the TSD provides criteria for evaluation of NFA at sites. Based on the criteria provided in Table 4 of the TSD, there has been no release of hazardous waste (including hazardous constituents) from this SWMU that pose a threat to human health or the environment. Consequently, there can be no transport of hazardous constituents from this SWMU.

2.2.2.3 Data Gaps

No data gaps exist for this SWMU.

2.2.3 Sampling Activities

No additional samples will be collected at this SWMU.

2.2.3.1 Containment Source

This section is not applicable.

2.2.3.2 Media Characterization

This section is not applicable.

3.0 SWMU 001h (H-15/P-2 MUD PITS)

The following subsections discuss the characterization and setting and field investigation activities that have been conducted at SWMU 001h.

3.1 Characterization and Setting

SWMU 001h is located in the Northeast (NE) ¼ of the NE ¼ of the NE ¼ of Section 28, Township 22 south, Range 31 east. Two boreholes were drilled at this location (H-15 and P-2). SWMU 001h consists of the mud pits constructed for the drilling of the P-2 potash exploration well and the H-15 Culebra test well.

3.1.1 Site Description

H-15 was drilled in 1986 to conduct a series of water quality evaluations and to develop a database of Culebra Formation water levels. The H-15 mud pit is a rectangular mud pit approximately 18 feet wide and 55 feet long, located approximately 18 feet east of the H-15 well cap and in the northeast corner of the P-2 drill pad area.

The P-2 mud pit is located approximately 40 feet southeast of the P-2 well head, on the eastern edge of the P-2 well pad. The P-2 mud pit is approximately 20 feet wide and 35 feet long. The P-2 well pad is not vegetated and is covered with compacted caliche.

3.1.2 Operational History

The P-2 borehole was drilled in September 1976 by Boyles Brothers Drilling Company as part of a 21-well USGS resource evaluation program to investigate the potash resources in the Salado Formation. The P-2 site was closed by the USGS in 1976.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

The H-15 test well was drilled to a total depth of 1,895 feet. After setting 20 feet of 7-inch casing, a 5.875-inch rotary borehole was drilled to 1,038 feet below land surface. A 4.5-inch casing liner was installed and the hole was deepened to 1,500 feet using a 3.94-inch rotary drill bit. The hole was drilled to the final depth of 1,895 feet using a 3.94-inch core bit.

3.1.3 Waste Characterization

USGS drilling logs indicate that air foam was used during the drilling of P-2. Salt mud was also used to complete the P-2 borehole.

Saturated brine and "traced" freshwater are listed as drilling fluid constituents in the H-15 borehole data report. Saturated brine is specifically described as a 70-30 mixture of cement slurry and salt with 2 percent bentonitic gel. Meta-trifluorobenzoic acid (2 mg/l) was added to measure borehole and aquifer contamination of the Culebra from the drilling

process. Approximately 1,336 gallons of traced drilling fluid were lost to the formation, representing about 75 percent of the drilling fluid used.

3.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

3.2.1 Existing Data

The following subsections describe data that were collected for SWMU 001h.

3.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

3.2.1.2 Sampling

During a summer 1995 sampling event at SWMU 001h, a total of 22 soil boring samples and 4 associated QA/QC samples were collected for TCLP metals analysis to assess the potential for release of hazardous constituents from SWMU 001h.

Soil sampling locations at the SWMU were sampled again in the summer of 1996. During the summer 1996 sampling event, 22 soil boring samples and 4 associated QA/QC samples were collected for total constituent analysis to further characterize the vertical and horizontal extent of any potential release of hazardous constituents from the SWMU 001h mud pits.

The rationale for selecting sample depths at mud pits was based on an evaluation of the SWMU 001h site, and historical information contained in the RFA. Samples collected for metals analyses in the mud pit area at the 12- to 24-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 60- to 72-inch depth were used to evaluate the maximum vertical extent of potential constituent migration. Figure 3.1 is a site map showing sample locations and barium concentrations at sample locations for SWMU 001h.

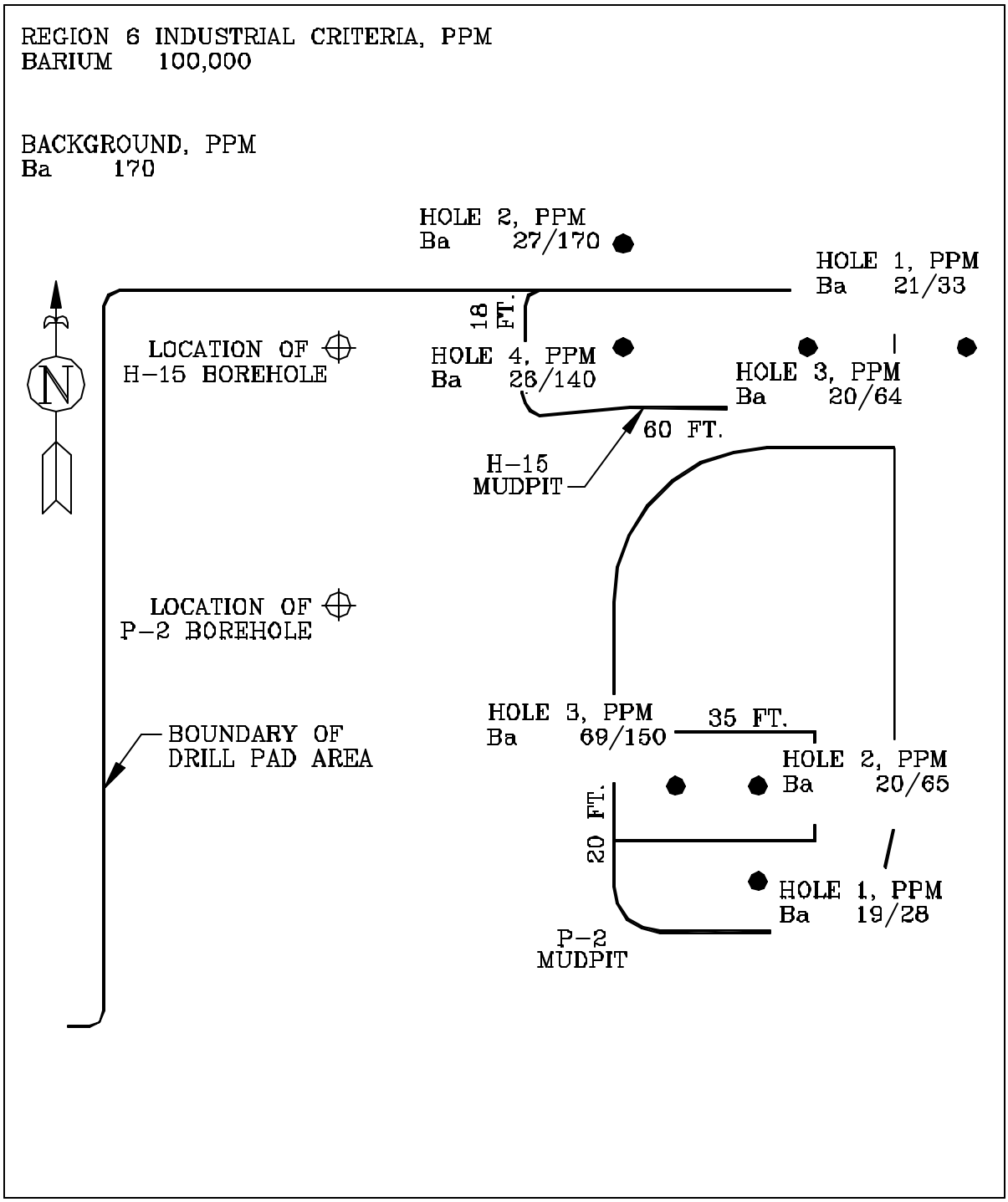

Figure 3.1 - Sample Location Map – SWMU 00lh (H-15 & P-2)

3.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

3.2.2.1 Nature and Extent of Contamination

The TSD identified barium and thallium as potential constituents of concern for the mud pit materials in this SWMU. Concentrations of barium were detected at SWMU 001h by total metals analyses (Table 3.1).

Total metals concentrations of barium measured in SWMU 001h are below the barium background concentration (Table 3.1 and Appendix A). In addition, as defined in Appendix B, thallium has been eliminated as a constituent of concern for the SWMUs. Based on the information contained in Table 3.1, Appendix A, and Appendix B, there has been no release of hazardous constituents at this SWMU. In addition, P-2 was closed by the USGS in 1976. Consequently, no additional investigations will be conducted at this SWMU.

Table 3.1
Summary of Measured Concentrations for Constituents of Concern
SWMU 001h (H-15 & P-2)

Description	Hole #	Depth (in. bgs)	Constituent	Concentration (ppm)	Qualifier
H-15 Mud Pit	1	12 to 24	Barium	21	
		60 to 72	Barium	33	
	2	12 to 24	Barium	27	
		60 to 72	Barium	170	
	3	12 to 24	Barium	20	
		60 to 72	Barium	64	
	4	12 to 24	Barium	26	
		60 to 72	Barium	140	
P-2 Mud Pit	1	12 to 24	Barium	19	
		60 to 72	Barium	28	
	2	12 to 24	Barium	20	
		60 to 72	Barium	65	
	3	12 to 24	Barium	69	
		60 to 72	Barium	150	

Notes:
Background concentration for barium = 170 ppm
ppm = parts per million
in. bgs = inches below ground surface
SWMU = Solid Waste Management Unit

3.2.2.2 Fate and Transport

As stated above, available data indicate that no hazardous constituents exist in SWMU 001h above background. Further, no release of hazardous constituents has occurred. Based on the criteria provided in Table 4 of the TSD, there has been no release of hazardous waste (including hazardous constituents) from this SWMU that poses a threat to human health or the environment. Consequently, there can be no transport of hazardous constituents from this SWMU.

3.2.2.3 Data Gaps

No data gaps exist for this SWMU.

3.2.3 Sampling Activities

No additional samples will be collected at this SWMU.

3.2.3.1 Contaminant Source

This section is not applicable.

3.2.3.2 Media Characterization

This section is not applicable.

4.0 SWMU 001j (P-3 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that have been conducted at SWMU 001j.

4.1 Characterization and Setting

SWMU 001j is located in the SE ¼ of the SE ¼ of the SW ¼ of Section 20, Township 22 south, Range 31 east. One borehole (P-3) was drilled at this location. The mud pit constructed for the drilling of the P-3 potash exploration well is SWMU 001j.

4.1.1 Site Description

The P-3 mud pit is a single rectangular mud pit that is located on the south central part of the drill pad. The P-3 well pad is heavily vegetated.

4.1.2 Operational History

The P-3 borehole was drilled by the Pennsylvania Drilling Company in August 1976 as part of a 21-well USGS resource evaluation program to investigate the potash resources in the Salado Formation. Once drilling of the P-3 borehole was completed, the hole was plugged to the surface. The P-3 site was closed by the USGS in 1976.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS if its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

4.1.3 Waste Characterization

Drilling fluids used at the P-3 site include mud, brine, and brine mud.

4.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

4.2.1 Existing Data

The following subsections describe data that were collected for SWMU 001j.

4.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

4.2.1.2 Sampling

During a summer 1995 sampling event, a total of 16 soil boring samples and 10 associated QA/QC samples were collected for TCLP metals analysis to assess the potential for release of hazardous constituents from the SWMU 001j mud pit. During a summer 1996 sampling event, 12 soil boring samples and 2 associated QA/QC samples were collected for total constituent analysis to further characterize the vertical and horizontal extent of any potential release of hazardous constituents from the SWMU 001j mud pit.

The rationale for selecting sample depths at mud pits during the previous sampling was based on an evaluation of the SWMU 001j site, and historical information contained in the RFA. Samples collected for metals analyses in the mud pit area at the 12- to 24-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 60- to 72-inch depth were used to evaluate the maximum vertical extent of potential constituent migration.

4.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

4.2.2.1 Nature and Extent of Contamination

This site was closed by the USGS in 1976. Consequently, no additional investigations will be conducted at this SWMU.

4.2.2.2 Fate and Transport

This section is not applicable.

4.2.2.3 Data Gaps

No data gaps exist for this SWMU.

4.2.3 Sampling Activities

No additional samples will be collected at this SWMU.

4.2.3.1 Contaminant Source

This section is not applicable.

4.2.3.2 Media Characterization

This section is not applicable.

5.0 SWMU 001k (P-4 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that have been and will be conducted at SWMU 001k.

5.1 Characterization and Setting

SWMU 001t is located in the SE ¼ of the SW ¼ of the SE ¼ of Section 28, Township 22 south, Range 31 east. The abandoned mud pit from the drilling of the P-4 borehole is SWMU 001k.

5.1.1 Site Description

The P-4 drill pad has been extensively graded and regraded since the mud pit was closed in 1976. The P-4 mud pit is located in a hummocky sand dune area on the west side of the 001k drill pad. The mud pit area sits at approximately a 45 degree angle to the P-4 drill pad and is approximately 15 feet wide and 70 feet long. Mixed, uncompacted soil, broken caliche, and red sandstone on the surface suggest extensive grading along the west side of the drill pad.

5.1.2 Operational History

The P-4 borehole was drilled by Boyles Brothers Drilling Company in August and September, 1976 as part of a 21-well USGS resource evaluation program to investigate the potash resources in the Salado Formation. The total depth of the hole was 1,858 feet. This site was closed by the USGS in 1976.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company Notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

5.1.3 Waste Characterization

Drilling fluids that may have been used to complete the P-4 borehole include brine and salt mud. Air foam was used beginning at a depth of 958 feet and continued until the hole was completed to maintain circulation and help remove cuttings from the hole.

5.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

5.2.1 Existing Data

The following subsections describe data that were collected for SWMU 001k.

5.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

5.2.1.2 Sampling

During a summer 1995 sampling event at SWMU 001k, a total of 12 soil boring samples and 4 associated QA/QC samples were collected for TCLP metals analysis to assess the potential for release of hazardous constituents from the SWMU 001k mud pit. Soil sampling locations at the SWMU were sampled again in the summer of 1996. During the summer 1996 sampling event, 12 soil boring samples and 2 associated QA/QC samples were collected for total constituent analysis to further characterize the vertical and horizontal extent of any potential release of hazardous constituents from the SWMU 001k mud pit.

In September 1999, a total of 8 soil boring samples and 1 associated QA/QC sample were collected and analyzed for total thallium.

The rationale for selecting sample depths at mud pits during the previous sampling was based on an evaluation of the SWMU 001k site, and historical information contained in the RFA. Samples collected for metals analyses in the mud pit area at the 12- to 24-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 60- to 72-inch depth were used to quantify the maximum vertical extent of potential constituent migration.

5.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

5.2.2.1 Nature and Extent of Contamination

This site was closed by the USGS is 1976. Consequently, no additional investigations will be conducted at this SWMU.

5.2.2.2 Fate and Transport

This section is not applicable.

5.2.2.3 Data Gaps

No data gaps exist for this SWMU.

5.2.3 Sampling Activities

No additional samples will be collected at this SWMU.

5.2.3.1 Contaminant Source

This section is not applicable.

5.2.3.2 Media Characterization

This section is not applicable.

6.0 SWMU 001L (WIPP-12/P-5 DRILLING MUD PITS)

The following subsections discuss the characterization and setting and field investigation activities that have been conducted at SWMU 001L.

6.1 Characterization and Setting

SWMU 001L is located in the SE ¼ of the SE ¼ of the SE ¼ of Section 17, Township 22 south, Range 31 east. SWMU 001L is made up of the mud pit complex developed for the drilling of the WIPP-12 exploration borehole and the mud pit constructed to support the drilling of the P-5 potash exploration borehole.

6.1.1 Site Description

The P-5 mud pit is located approximately 45 feet south of the P-5 borehole. The P-5 mud pit is approximately 18 feet wide and 60 feet long. The area around the P-5 mud pit is made up of compacted caliche. There is essentially no vegetative growth on the P-5 drill pad.

The large WIPP-12 mud pit complex is made up of four individual mud pits located on the eastern site of the drill pad. This site is characterized by hummocky, dark bands of fill material that form the berms separating four distinct rectangular mud pits. The four mud pits run in a north/south direction and are approximately 330-by-75 feet; 360-by-40 feet; 360-by-36 feet; and 330-by-75 feet, respectively. Linear dark bands of soil and stressed or sparse vegetation delineate the mud pit location. The mud pit areas are rough graded, exposing a mixture of surface sands and caliche material.

6.1.2 Operational History

The Pennsylvania Drilling Company drilled P-5 in 1976 as part of a 21-well USGS resource evaluation program to investigate the potash resources in the Salado Formation. The P-5 site was closed by the USGS in 1976.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

WIPP-12 was drilled on the P-5 well pad in 1978 and deepened in 1981 and 1982 to investigate lithologic and stratigraphic details of the Salado and Castile Formations. WIPP-12 was drilled to a total depth of 3,928 feet.

6.1.3 Waste Characterization

Drilling fluid mixtures used at this site include salt mud, diesel oil, and mud.

Several types of drilling fluids were used to drill WIPP-12. A salt-based drilling mud was used to a depth of 1,000 feet, a 10-pounds/gallon mix of starch, soda ash, and caustic soda (NaOH for pH control) was used between 1,000 and 2,773 feet, and a brine-salt gel (attapulgite) mixture was used to 3,927 feet. A NaCl-based weighing agent was added to control the flow from a pressurized brine encountered at 3,011 feet below the surface. An organic material (lignite) and a density-increasing material such as barite may also have been used.

6.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

6.2.1 Existing Data

The following subsections describe data that were collected at SWMU 001L.

6.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

6.2.1.2 Sampling

During a summer 1995 sampling event at SWMU 001L, a total of 20 soil boring samples and 4 associated QA/QC samples were collected for TCLP metals analysis to assess the potential for release of hazardous constituents from SWMU 001L. Soil sampling locations at the SWMU were sampled again in the summer of 1996. During the summer 1996 sampling event, 20 soil boring samples and 4 associated QA/QC samples were collected for total constituent analysis to further characterize the vertical and horizontal extent of any potential release of hazardous constituents from the SWMU 001L mud pits.

The rationale for selecting sample depths at mud pits was based on an evaluation of the SWMU 001L site, and historical information contained in the RFA. Samples collected for metals analyses in the mud pit area at the 12- to 24-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 60- to 72-inch depth were used to evaluate the maximum vertical extent of potential constituent migration. Figure 6.1 is a site map showing sample locations and barium and lead concentrations for sample locations at the WIPP-12 mud pits at SWMU 001L.

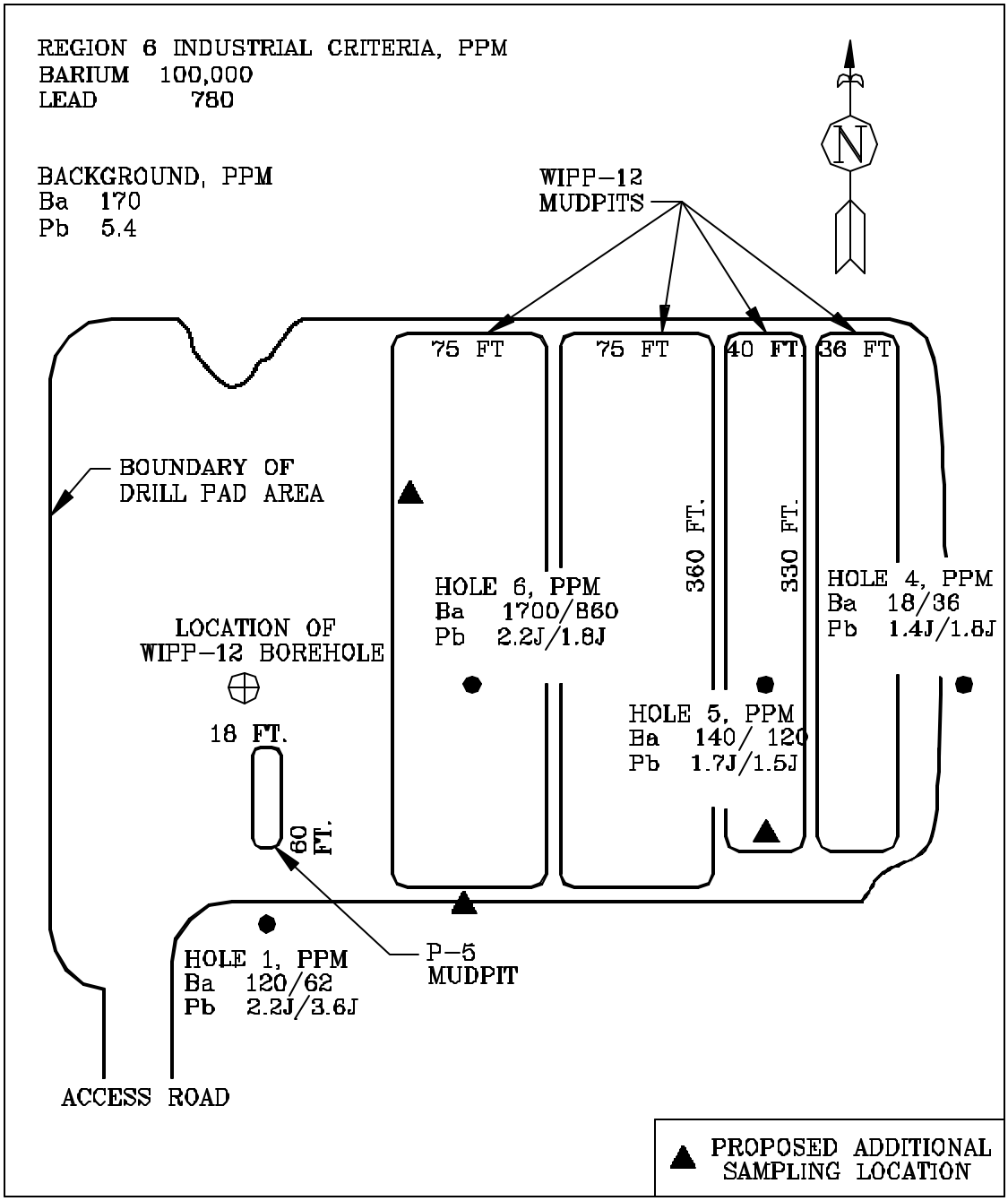

Figure 6.1 - Sample Location Map – SWMU 001L (WIPP-12 & P-5)

6.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

6.2.2.1 Nature and Extent of Contamination

The TSD identified barium, lead, and thallium as potential constituents of concern for the mud pit materials in this SWMU. Concentrations of barium and lead were detected in the WIPP-12 mud pits at SWMU 001L by total metals analysis (Table 6.1). Total metals concentrations of lead measured in SWMU 001L are below the lead background concentration (Table 6.1 and Appendix A). In addition, as defined in Appendix B, thallium has been eliminated as a constituent of concern for the SWMUs and AOCs. Based on the information contained in Table 6.1, Appendix A, and Appendix B, the investigations will be implemented to define the extent of the barium concentrations above background in the WIPP-12 mud pits. The P-5 mud pit was closed by the USGS in 1976 and will not be investigated.

Table 6.1
Summary of Measured Concentrations for Constituents of Concern
SWMU 001L (WIPP-12)

Description	Hole #	Depth (in. bgs)	Constituent	Concentration (ppm)	Qualifier
WIPP-12 Mud Pits	1	12 to 24	Barium	120	
			Lead	2.2	J
		60 to 72	Barium	62	
			Lead	3.6	J
	4	12 to 24	Barium	18	
			Lead	1.4	J
		60 to 72	Barium	36	
			Lead	1.8	J
	5	12 to 24	Barium	140	
			Lead	1.7	J
		60 to 72	Barium	120	
			Lead	1.5	J
	6	12 to 24	Barium	1700	
			Lead	2.2	J
		60 to 72	Barium	860	
			Lead	1.8	J

Notes:
Background concentration for barium = 170 ppm
Background concentration for lead = 5.4 ppm
ppm = parts per million
in. bgs = inches below ground surface
J = Result should be considered an estimated value.
SWMU = Solid Waste Management Unit

6.2.2.2 Fate and Transport

The depth to proven groundwater below SWMU 001L is at least 804 feet, and it is estimated that less than 0.5 inch of precipitation per year infiltrates the underlying strata. Thus, the potential to migrate to groundwater is extremely low. The mud pit material has been covered with native soil excavated from the mud pit, so there is no possibility for surface water or wind transport of mud pit material. Furthermore, because the land has been withdrawn from public use and the potential for intrusive activities is low, the potential exposure of human receptors to metals in the SWMU is minimal to nonexistent.

6.2.2.3 Data Gaps

Additional data will be collected as described in section 6.2.3 below.

6.2.3 Sampling Activities

The proposed scope of work at SWMU 001L includes the collection of subsurface soil samples within and outside of the SWMU boundary by means of direct push (or comparable) methodology. Direct push technology refers to the forcing of a sampling device constructed of stainless steel to the desired sampling depth using a hydraulic ram.

6.2.3.1 Contaminant Source

The proposed scope of work at SWMU 001L includes the collection of soil samples from three locations: two locations in the WIPP-12 mud pits, and one location outside the mud pits to further define the extent of barium concentrations above background. At each location, two subsurface samples will be collected; one from a two-foot interval within the mud pit material, and the second from a 12- to 24-inch interval below the mud/soil interface. The soil samples will be analyzed for total barium. The approximate locations for proposed sampling are represented in Figure 6.1.

6.2.3.2 Media Characterization

All soil samples collected will be shipped in split spoon soil liners (or equivalent containers) to a WIPP approved laboratory and analyzed for barium by EPA SW-846 Method 6010A (EPA, 1997). Prior to analysis, the laboratory will homogenize the soil from the liner in each sampling interval to obtain a representative sample for each vertical interval. The process will be described in the appropriate laboratory standard operating procedure (SOP). The remaining portion of that sample will be archived.

7.0 SWMU 001m (P-6 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that have been and will be conducted at SWMU 001m.

7.1 Characterization and Setting

SWMU 001m is located in the SW ¼ of the SW ¼ of the NW ¼ of Section 30, Township 22 south, Range 31 east. SWMU 001m is the abandoned mud pit generated by the drilling of the P-6 exploration well.

7.1.1 Site Description

The access roads and the surface of the site have been rough graded. The edges of the mud pit are not easily distinguished, so information from a visual site inspection described in the RFA was used to survey the location of the P-6 mud pit.

7.1.2 Operational History

Boyles Brothers Drilling Company drilled P-6 potash exploration well in September 1976 as part of a 21-well USGS resource evaluation program to investigate the potash resources in the Salado Formation. One joint of 3-1/2-inch O.D. casing was set in soft cement and cut off 1 foot above the ground level to mark the hole. The P-6 site was closed by the USGS in 1976.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

7.1.3 Waste Characterization

As with other USGS potash resource evaluation boreholes, salt mud was used to complete the P-6 borehole.

7.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

7.2.1 Existing Data

The following subsections describe data that were collected at SWMU 001m.

7.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

7.2.1.2 Sampling

During a summer 1995 sampling event at SWMU 001m, a total of 16 soil boring samples and 6 associated QA/QC samples were collected for TCLP metals analysis to assess the potential for release of hazardous constituents from the SWMU 001m mud pit. During a summer 1996 sampling event, 12 soil boring samples and two associated QA/QC samples were collected for total constituent analysis to further characterize the vertical and horizontal extent of any potential release of hazardous constituents from the SWMU 001m mud pit.

In September 1999, a total of 8 soil boring samples and 2 associated QA/QC samples were collected for total thallium analysis.

The rationale for selecting sample depths at mud during the previous sampling was based on an evaluation of the SWMU 001m site, and historical information contained in the RFA. Samples collected for metals analyses in the mud pit area at the 12- to 24-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 60- to 72-inch depth were used to evaluate the maximum vertical extent of potential constituent migration.

7.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

7.2.2.1 Nature and Extent of Contamination

This site was closed by the USGS in 1976. Consequently, no additional investigation will be conducted at this SWMU.

7.2.2.2 Fate and Transport

This section is not applicable.

7.2.2.3 Data Gaps

No data gaps exist for this SWMU.

7.2.3 Sampling Activities

No additional samples will be collected at this SWMU.

7.2.3.1 Contaminant Source

This section is not applicable.

7.2.3.2 Media Characterization

This section is not applicable.

8.0 SWMU 001n (P-15 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that have been conducted at SWMU 001n.

8.1 Characterization and Setting

SWMU 001n is located in the SW ¼ of the SW ¼ of the SW ¼ of Section 31, Township 22 south, range 31 East. The mud pit constructed for the drilling of the P-15 potash exploration well is SWMU 001n.

8.1.1 Site Description

Location data contained in the RFA were used to survey the location of the P-15 mud pit. A single rectangular mud pit approximately 10 feet wide and 20 feet long is located on the northeastern edge of the drill pad. The P-15 well pad is heavily vegetated, and no discolored soil or liner material were identified during sampling activities.

8.1.2 Operational History

Boyles Brothers Drilling Company drilled the P-15 borehole in October 1976 as part of a 21-well USGS resource evaluation program to investigate the potash resources in the Salado Formation. USGS drill reports indicate that the P-15 borehole was drilled with air

to a depth of 405 feet. The well was recompleted in 1979 to a depth of 1,465 feet. This site was closed by the USGS with BLM concurrence.

8.1.3 Waste Characterization

As with other USGS potash test boreholes, a salt-based mud was used to complete the P-15 borehole.

8.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

8.2.1 Existing Data

The following subsections describe data that were collected for SWMU 001n.

8.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

8.2.1.2 Sampling

During a summer 1995 sampling event at SWMU 001n, a total of 16 soil boring samples and 8 associated QA/QC samples were collected for TCLP metals analysis to assess the potential for release of hazardous constituents from the SWMU 001n mud pit. Soil sampling locations at the SWMU were sampled again in the summer of 1996. During the summer 1996 sampling event, 12 soil boring samples and two associated QA/QC samples were collected for total constituent analysis to further characterize the vertical and horizontal extent of any potential release of hazardous constituents from the SWMU 001n mud pit.

In September 1999, a total of eight soil boring samples and three associated QA/QC samples were collected for total thallium analysis.

The rationale for selecting sample depths at mud pits during the previous sampling was based on an evaluation of the SWMU 001n site, and historical information contained in the RFA. Samples collected for metals analyses in the mud pit area at the 12- to 24-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 60- to 72-inch depth were used to evaluate the maximum vertical extent of potential constituent migration.

8.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

8.2.2.1 Nature and Extent of Contamination

This site was closed by the USGS. Consequently, no additional investigation will be conducted at this SWMU.

8.2.2.2 Fate and Transport

This section is not applicable.

8.2.2.3 Data Gaps

No data gaps exist for this SWMU.

8.2.3 Sampling Activities

No additional samples will be collected at this SWMU.

8.2.3.1 Contaminant Source

This section is not applicable.

8.2.3.2 Media Characterization

This section is not applicable.

9.0 SWMU 001o (BADGER UNIT MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that have been and will be conducted at SWMU 001o.

9.1 Characterization and Setting

SWMU 001o is located in the NW ¼ of the NE ¼ of the SW ¼ of Section 15, Township 22 south, Range 31 east. The mud pit constructed for the drilling of the petroleum exploration well is SWMU 001o.

9.1.1 Site Description

The mud pit area is a large stained nonvegetated area ringed with stressed vegetation. Many fragments of intact black polyethylene plastic liner protrude through the surface as much as 20 feet outside the stained soil area. The entire area measures approximately 280 feet by 400 feet and appears to have been graded.

9.1.2 Operational History

USGS well records indicate that the Badger Unit Federal #1 well was drilled in 1973 by Superior Oil Company as a wildcat petroleum exploration well. The total well depth was 15,225 feet, and the well was abandoned in 1974. The well was closed by the New Mexico Oil Conservation Commission (NMOCC) in 1974 with the concurrence of the BLM.

9.1.3 Waste Characterization

Drilling fluids used in the drilling of the Badger Unit Federal #1 well included the following: saturated brine water, potassium chloride brine, fresh water gel, polymer, and sodium hydroxide.

9.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

9.2.1 Existing Data

The following subsections describe data that were collected at SWMU 001o.

9.2.1.1 Nonsampling

No nonsampling activities have been performed at this SWMU.

9.2.1.2 Sampling

On two occasions during 1992 as part of the RFA, soil boring samples were collected by NMED and WIPP for total constituent analysis to assess the potential for release of hazardous constituents from the SWMU 001o mud pit.

Samples collected for metals analyses in the mud pit area at the 18- to 24-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 84- to 90-inch depth were used to evaluate the maximum vertical extent of potential constituent migration.

9.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

9.2.2.1 Nature and Extent of Contamination

This site was closed by NMOCC and BLM in 1974. Consequently, no additional investigations will be conducted at this SWMU.

9.2.2.2 Fate and Transport

This section is not applicable.

9.2.2.3 Data Gaps

No data gaps exist for this SWMU.

9.2.3 Sampling Activities

No additional samples will be collected at this SWMU.

9.2.3.1 Contaminant Source

This section is not applicable.

9.2.3.2 Media Characterization

This section is not applicable.

10.0 SWMU 001p (COTTON BABY DRILLING MUD PITS)

The following subsections discuss the characterization and setting and field investigation activities that have been and will be conducted at SWMU 001p.

10.1 Characterization and Setting

SWMU 001p is located in the SW ¼ of the NE ¼ of the SW ¼ of Section 34, Township 22 south, Range 31 east. The mud pits constructed for the drilling of the petroleum exploration well are SWMU 001p. The total well depth was 4,475 feet, and the well was abandoned in 1974.

10.1.1 Site Description

There are two stained mud pits on the Cotton Baby drill pad. The remnants of plastic liner material, and stressed and wilted vegetation can be seen at both mud pits. The smaller rectangular mud pit on the east side of the drill pad measures approximately 15 feet by 55 feet. A second irregularly shaped mud pit is located to the west of the smaller mud pit and measures approximately 65 feet by 85 feet.

10.1.2 Operational History

The Cotton Baby well was drilled in 1973 by Michael Grace Company as a wildcat petroleum exploration well. The total well depth was 4,475 feet, and the well was abandoned in 1974. This site was closed by the NMOCC with the concurrence of the BLM in 1974.

10.1.3 Waste Characterization

Drilling fluids used in the drilling of the Cotton Baby well included the following: drilling mud, spot oil, and water.

10.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

10.2.1 Existing Data

The following subsections describe data that were collected at SWMU 001p.

10.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

10.2.1.2 Sampling

During the 1992 RFA, soil boring samples were collected by NMED and WIPP for total metals analysis to assess the potential for release of hazardous constituents from the SWMU 001p mud pit.

Samples collected for metals analyses in the mud pit area at the 22.8- to 26.4-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 61.2- to 66-inch depth were used to evaluate the maximum vertical extent of potential constituent migration.

10.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

10.2.2.1 Nature and Extent of Contamination

This site was closed by the NMOCC and the BLM in 1974. Consequently, no additional investigations will be conducted at this SWMU.

10.2.2.2 Fate and Transport

This section is not applicable.

10.2.2.3 Data Gaps

No data gaps exist for this SWMU.

10.2.3 Sampling Activities

No additional samples will be collected at this SWMU.

10.2.3.1 Contaminant Source

This section is not applicable.

10.2.3.2 Media Characterization

This section is not applicable.

11.0 SWMU 001q (DOE-1 DRILLING MUD PITS)

The following subsections discuss the characterization and setting and field investigation activities that have been and will be conducted at SWMU 001q.

11.1 Characterization and Setting

SWMU 001q is located in the SE ¼ of the SE ¼ of the SE ¼ of Section 28, Township 22 south, Range 31 east. The DOE-1 was drilled in 1982 to collect stratigraphic, structural, and hydrologic data. The mud pits constructed for the drilling of DOE-1 comprise SWMU 001q.

11.1.1 Site Description

There are two mud pits at the DOE-1 drill pad. The primary pit measures approximately 150 feet by 45 feet, and a second reserve pit encompasses an area approximately 50 feet by 75 feet. Both areas were lined with 8 mil (8 thousandths of an inch) reinforced polyethylene liner. Only one of the mud pits appears to have been used.

11.1.2 Operational History

Salazar Brothers drilled the DOE-1 borehole to a depth of 4,065 feet to examine the nature of the Castile Formation. Field operations were initiated July 1982 and completed in that same month.

11.1.3 Waste Characterization

Drilling fluids used in the drilling of DOE-1 included the following components: fresh water gel, soda ash, paper, salt water gel, starch, potassium chloride brine, and lime.

11.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

11.2.1 Existing Data

The following subsections describe data that were collected at SWMU 001q.

11.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

11.2.1.2 Sampling

Soil samples were collected by WIPP and NMED during the 1992 RFA. The samples collected were submitted for total constituent analysis to assess the potential for release of hazardous constituents from the SWMU 001p mud pit.

Samples collected for metals analyses in the mud pit area at the 21.6- to 25.2-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 27.6- to 32.4-inch depth were used to evaluate the maximum vertical extent of potential constituent migration. Figure 11.1 is a site map showing sample locations and total barium, chromium, lead, and nickel concentrations for sample locations at SWMU 001q.

11.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

11.2.2.1 Nature and Extent of Contamination

The TSD identified barium, chromium, and lead as potential constituents of concern for the mud pit materials in this SWMU. In addition, WIPP has identified nickel as a constituent of concern at this SWMU. Concentrations of chromium, nickel, and lead were detected above background at SWMU 001q by total metals analysis (Table 11.1). Based on the information contained in Table 11.1, the investigations will be implemented to define the extent of the chromium, lead and nickel concentrations above background. No other constituent will be investigated.

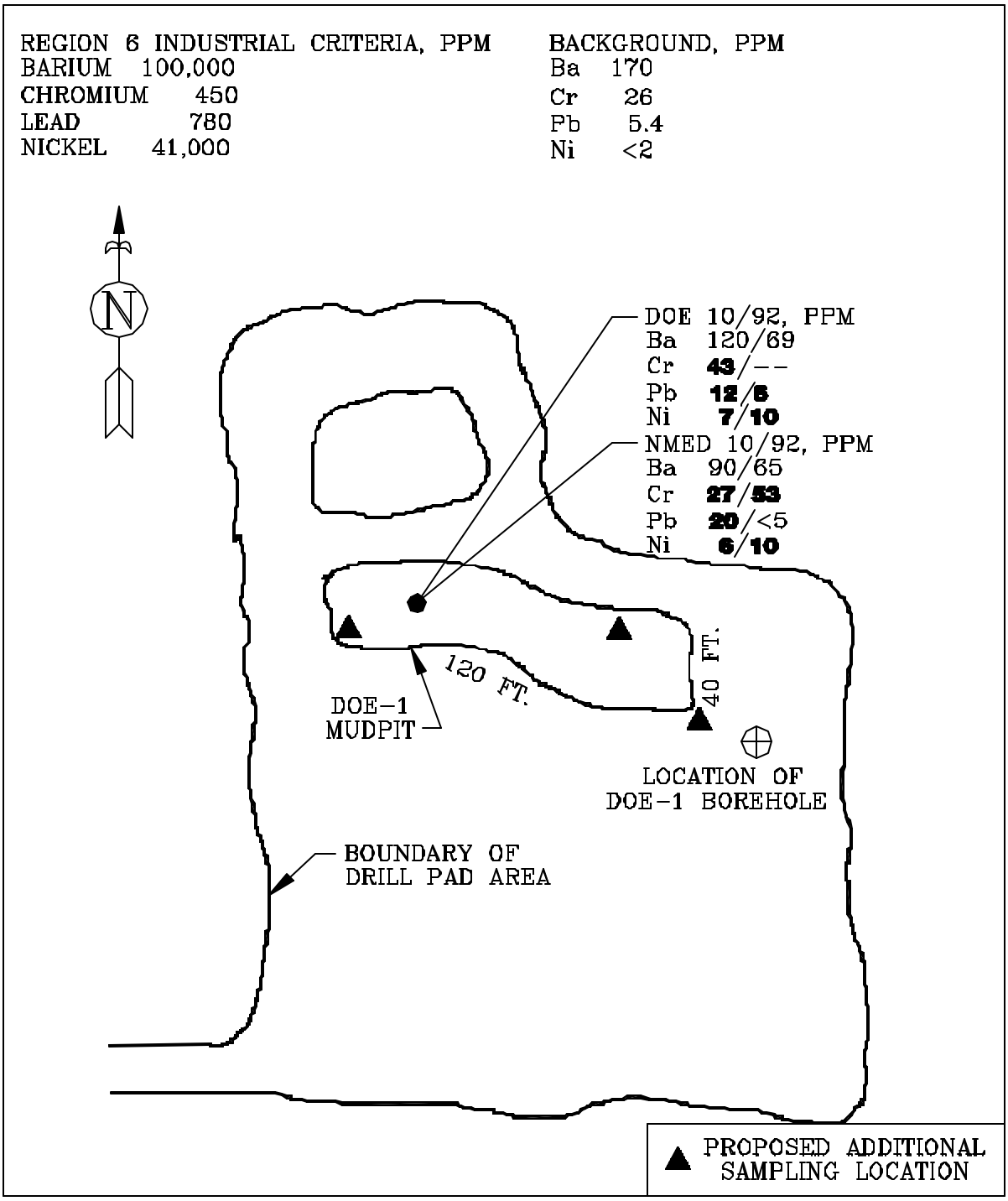

Figure 11.1 - Sample Location Map – SWMU 001q (DOE-1)

Table 11.1
Summary of Measured Concentrations for Constituents of Concern
SWMU 001q (DOE-1)

Description	Hole #	Depth (in. bgs)	Constituent	Concentration (ppm)	Qualifier
DOE-1	A[(1)]	21.6 to 25.2	Barium	120	
			Chromium	43	
			Lead	12	
		27.6 to 32.4	Barium	69	
			Chromium	-	
			Lead	6	
	A[(2)]	21.6 to 25.2	Barium	90	
			Chromium	27	
			Lead	20	
		27.6 to 32.4	Barium	65	
			Chromium	53	
			Lead	5	U

Notes:
Background concentration for barium = 170 ppm
Background concentration for chromium = 26 ppm
Background concentration for lead = 5.4 ppm
(1) Sampled by DOE 10/92
(2) Sampled by NMED 10/92
- = Sample result not available
NMED = New Mexico Environment Department
ppm = parts per million
in. bgs = inches below ground surface.
SWMU = Solid Waste Management Unit
U = Analyte was not detected; value is the method reporting limit.

11.2.2.2 Fate and Transport

The depth to proven groundwater in the Culebra Formation below SWMU 001o is 400 to 500 feet, and it is estimated that less than 0.5 inch of precipitation per year infiltrates the underlying strata. Thus, the potential for these metals to migrate to groundwater is extremely low. The surface material at this SWMU is potentially susceptible to surface water run-on. In the fall of 1999, WIPP installed silt fences and trenches at this SWMU to control potential surface run-on during rain storm events as a best management practice for the SWMU. Furthermore, because the land has been withdrawn from public use and the potential for intrusive activities is low, the potential exposure of human receptors to metals in the SWMU is minimal to nonexistent.

11.2.2.3 Data Gaps

Additional data will be collected as described in section 11.2.3 below.

11.2.3 Sampling Activities

The proposed scope of work at SWMU 001q includes the collection of subsurface soil samples within and outside of the SWMU boundary by means of direct push (or comparable) methodology.

11.2.3.1 Contaminant Source

The proposed scope of work at SWMU 001q includes the collection of soil samples from three locations: two locations in the DOE-1 mud pit, and one location outside of the mud pit to further define the extent of chromium, lead and nickel concentrations above background. At each location, two subsurface samples will be collected, one from a two-foot interval within the mud pit material, and the second from a 12- to 24-inch interval below the mud/soil interface. The soil samples will be analyzed for total lead, total chromium, and total nickel. The approximate locations for proposed sampling are represented in Figure 11.1.

11.2.3.2 Media Characterization

All soil samples collected will be shipped in split spoon soil liners (or equivalent containers) to a WIPP approved laboratory and analyzed for barium by EPA SW-846 Method 6010B (EPA, 1997). Prior to analysis, the laboratory will homogenize the soil from the liner in each sampling interval to obtain a representative sample for each vertical interval. The process will be described in the appropriate laboratory SOP. The remaining portion of that sample will be archived.

12.0 SWMU 001s (ERDA-9 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that have been and will be conducted at SWMU 001s.

12.1 Characterization and Setting

SWMU 001s is located in the SE ¼ of the SE ¼ of the SE ¼ of Section 20, Township 22 south, range 31 East. The abandoned mud pit constructed for the drilling of the ERDA-9 borehole is SWMU 001s.

12.1.1 Site Description

The ERDA-9 mud pit area is transected by the south WIPP security fence. Information contained in the WIPP RFA describes the mud pit location. A rectangular discolored zone identified in 1982 aerial photographs is now partially covered by a railroad embankment and the compacted caliche used in the construction of the site. The drill pad where the ERDA-9 borehole and associated mud pit are located have been extensively graded and regraded.

12.1.2 Operational History

ERDA-9 was the first WIPP exploratory borehole to test salt beds for the disposal of transuranic wastes at the proposed WIPP site. A proposed earthen emergency pit was constructed to support the closed-mud circulation system. Aerial photographs show a discolored rectangular zone just to the north-northwest of the well head, suggesting that the emergency pit was used. The feature measured approximately 50 feet by 145 feet.

The ERDA-9 borehole was recompleted in October 1986, as a Culebra observation well. Recompletion work involved cutting the 7-inch casing in ERDA-9 at a depth of 980 feet with an explosive charge and removing the casing from the borehole. A 7-inch retrievable bridge plug was installed inside the 10.75-inch casing at a depth of 760 feet from the top of the wellhead.

12.1.3 Waste Characterization

Salt-based drilling fluids were used for the first 1,033 feet of the borehole. The well was then deepened to 2,877 feet using an oil-emulsion drilling mud composed of diesel fuel, water, EZ MUD liquid emulsifier GELTONE viscofier, and calcium chloride.

During recompletion, the well was flushed with approximately 13,200 gallons of fresh water, followed by 6,340 gallons of a 0.27 mg/l solution of MilChem-MD detergent-type degreaser. All detergent-laden rinse solutions were collected in surface fractionation tanks and transported to an offsite disposal facility.

12.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

12.2.1 Existing Data

The following subsections describe data that were collected at SWMU 001s.

12.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

12.2.1.2 Sampling

During a summer 1995 sampling event at SWMU 001s, a total of 12 soil boring samples and 4 associated QA/QC samples were collected for TCLP metals analysis to assess the potential for release of hazardous constituents from the SWMU 001s mud pit. Soil sampling locations at the SWMU were sampled again in the summer of 1996. During the summer 1996 sampling event, 12 soil boring samples and 2 associated QA/QC samples were collected for total constituent analysis to further characterize the vertical and horizontal extent of any potential release of hazardous constituents from the SWMU 001s mud pits.

In September 1999, a total of 8 soil boring samples and 1 associated QA/QC sample were collected for total thallium analysis.

The rationale for selecting sample depths at mud pits during the previous sampling was based on an evaluation of the SWMU 001s site, and historical information contained in the RFA. Samples collected for metals analyses in the mud pit area at the 12- to 24-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 60- to 72-inch depth were used to evaluate the maximum vertical extent of potential constituent migration.

12.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

12.2.2.1 Nature and Extent of Contamination

The TSD identified thallium as a potential constituent of concern for the mud pit materials in this SWMU. As described in Appendix B, samples were collected at this SWMU in September 1999 and analyzed for thallium. Thallium was detected in one sample collected outside of the SWMU. As described in Appendix B, thallium has been eliminated as a constituent of concern for the SWMUs. Based on the information contained in Appendix B, there has been no release of hazardous constituents at this SWMU. Consequently, no additional investigation will be conducted at this SWMU.

12.2.2.2 Fate and Transport

As stated above, available data indicate that no hazardous constituents exist in SWMU 001s above background. Further, no release of hazardous constituents has occurred. Based on the criteria provided in Table 4 of the TSD, there has been no release of hazardous waste (including hazardous constituents) from this SWMU that poses a threat to human health or the environment. Consequently, there can be no transport of hazardous constituents from this SWMU.

12.2.2.3 Data Gaps

No data gaps exist for this SWMU.

12.2.3 Sampling Activities

No additional samples will be collected at this SWMU.

12.2.3.1 Contaminant Source

This section is not applicable.

12.2.3.2 Media Characterization

This section is not applicable.

13.0 SWMU 001t (IMC-374 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that have been conducted at SWMU 001t.

13.1 Characterization and Setting

SWMU 001t is located in the SE ¼ of the SE ¼ of the SW ¼ of Section 30, Township 22 south, Range 31 east. The abandoned mud pit constructed for the drilling of borehole number 374 by the International Mineral and Chemical Corporation (IMC-374) is SWMU 001t.

13.1.1 Site Description

The mud pit area is located in a hummocky sandy area along the west side of the drill pad. The mud pit area measures approximately 15 feet by 70 feet. No mud pit liners were encountered during the boring of sampling sites. An area of slightly stained soil, originally referenced in the RFA was not evident during the sampling visits, and may have resulted from a precipitation event prior to the RFA site visit.

13.1.2 Operational History

The IMC-374 exploration borehole was drilled by Boyles Brothers Drilling Company in April 1965. The total depth of the hole was 1,149 feet. The IMC-374 site was closed by the USGS in 1965.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

13.1.3 Waste Characterization

Saturated brine was used to complete the IMC-374 borehole.

13.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

13.2.1 Existing Data

The following subsections describe data that were collected at SWMU 001t.

13.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

13.2.1.2 Sampling

During the Summer 1995 sampling event at SWMU 001t, a total of 20 soil boring samples and 6 associated QA/QC samples were collected for TCLP metals analysis to assess the potential for release of hazardous constituents from the SWMU 001t mud pit. Soil sampling locations at the SWMU were sampled again in Summer 1996. During the Summer 1996 sampling event, 12 soil boring samples and two associated QA/QC samples were collected for total constituent analysis to further characterize the vertical and horizontal extent of any potential release of hazardous constituents from the SWMU 001t mud pit.

During September 1999, a total of 10 soil boring samples and 3 associated QA/QC samples were collected and analyzed for total thallium.

The rationale for selecting sample depths at mud pits during the previous sampling was based on an evaluation of the SWMU 001t site, and historical information contained in the RFA. Samples collected for metals analyses in the mud pit area at the 12- to 24-inch depth were used to provide data from the depth where the highest concentration of potential hazardous constituents was anticipated. Samples collected at the 60- to 72-inch depth were used to evaluate the maximum vertical extent of potential constituent migration.

13.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

13.2.2.1 Nature and Extent of Contamination

This site was closed by the USGS in 1965. Consequently, no additional investigations will be conducted at this SWMU.

13.2.2.2 Fate and Transport

This section is not applicable.

13.2.2.3 Data Gaps

No data gaps exist for this SWMU.

13.2.3 Sampling Activities

No additional samples will be collected at this SWMU.

13.2.3.1 Contaminant Source

This section is not applicable.

13.2.3.2 Media Characterization

This section is not applicable.

14.0 SWMU 001x (WIPP-13 DRILLING MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that have been and will be conducted at SWMU 001x.

14.1 Characterization and Setting

SWMU 001x is located in the NW ¼ of the NE ¼ of the SW ¼ of Section 17, Township 22 south, Range 31 east. The abandoned mud pit constructed for the drilling of borehole number WIPP-13 is SWMU 001x.

14.1.1 Site Description

During the sampling visits to SWMU 001x, a single mud pit was located that measures approximately 100 feet wide and 120 feet long. The mud pits area is sunken approximately 1.5 feet below the surface grade of the pad. No vegetation is growing on the mud pit area, and the soil in the mud pit is a dark grey color. Black plastic liners protrude through the surface and delineate the mud pit.

14.1.2 Operational History

The WIPP-13 borehole was drilled by the Pennsylvania Drilling company in July 1978 to a depth of 1,025 feet. The borehole as deepened to 3,850 feet in 1979. Once drilling of the WIPP-13 borehole was completed in 1978, the entire 8-inch borehole was filled with salt-

based drilling mud. In 1979, the well was reamed to a 12.25-inch open hole diameter. The hole was then cased and cemented with 9.75-inch casing, to the upper part of the Salado Formation at a depth of 1,025 feet. The hole was then deepened to a depth of 3,850 feet in the Castile Formation. WIPP-13 was left filled with a brine-gel drilling fluid and capped at the surface. In 1985, the hole was acidified after a retrievable bridge plug was set in the casing at a depth of approximately 740 feet. The casing was then perforated between 702 feet and 727 feet. This portion of the hole was capped at the surface and the hole left open for water level monitoring.

14.1.3 Waste Characterization

Salt-based drilling fluid was used during initial drilling and a brine-gel mixture was used for later reaming and deepening of the hole in 1979. Additionally 8,600 liters of a 20 percent concentration hydrochloric acid solution was used in 1986 to complete the well for monitoring purposes. Aerial photographs from 1986 show no evidence that the mud pit was reopened for this activity.

14.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

14.2.1 Existing Data

The following subsections describe data that were collected at SWMU 001x.

14.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

14.2.1.2 Sampling

During a summer 1995 sampling event at SWMU 001x, a total of 16 soil boring samples and 8 associated QA/QC samples were collected for TCLP metals analysis to assess the potential for release of hazardous constituents from the SWMU 001x mud pit. Soil sampling locations at the SWMU were sampled again in the summer of 1996. During the summer 1996 sampling event, 12 soil boring samples and 2 associated QA/QC samples were collected for total constituent analysis to further characterize the vertical and horizontal extent of any potential release of hazardous constituents from the SWMU 001x mud pit.

The rationale for selecting sample depths at mud pits during the previous sampling was based on an evaluation of the SWMU 001x site, and historical information contained in the RFA. Samples collected for metals analyses in the mud pit area at the 12- to 24-inch depth were used to provide data from the depth where the highest concentration of potential

hazardous constituents was anticipated. Samples collected at the 60- to 72-inch depth were used to quantify the maximum vertical extent of potential constituent migration. Figure 14.1 is a site map showing sample locations and barium, chromium, and lead concentrations for sample locations at SWMU 001x.

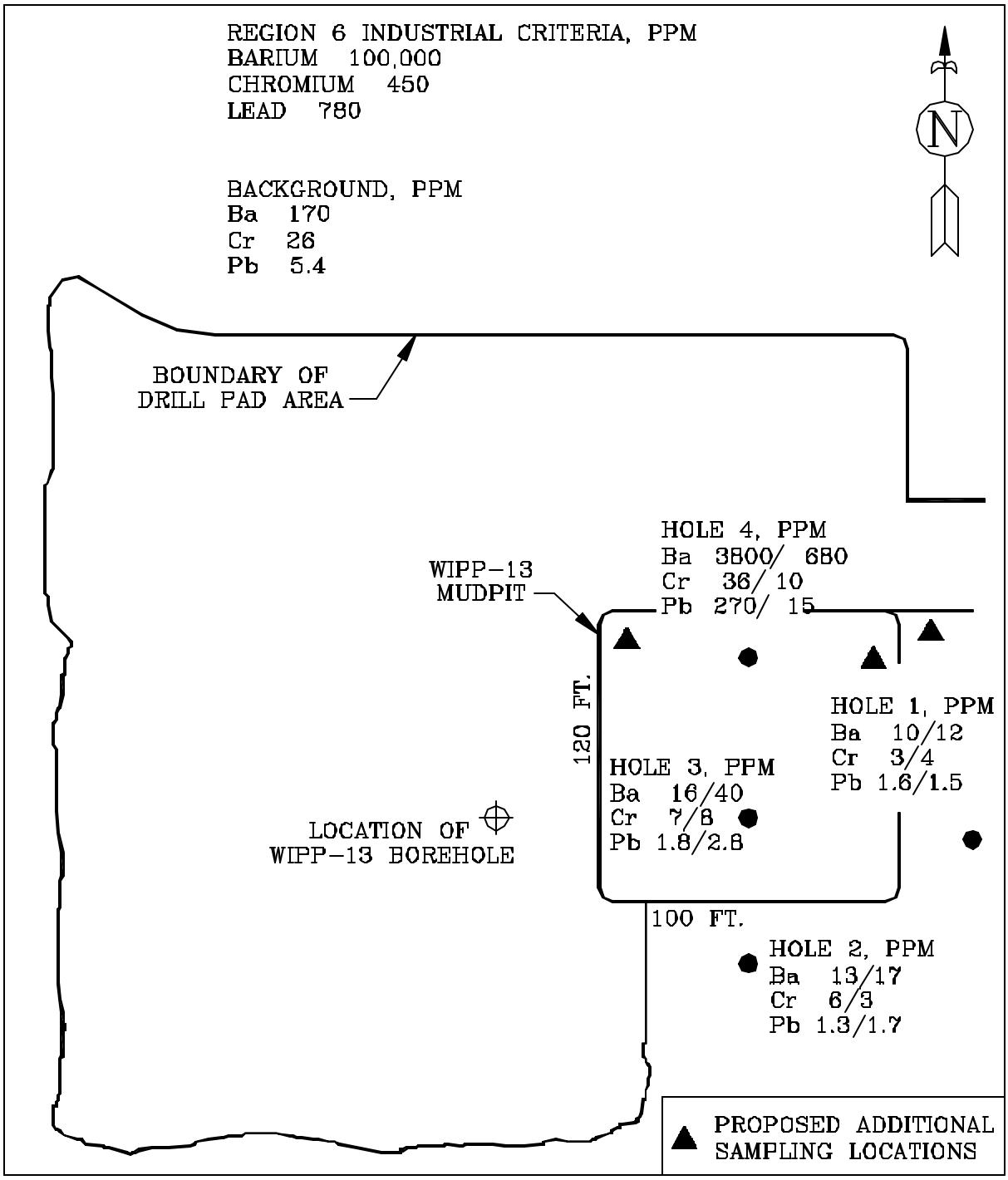

Figure 14.1 - Sample Location Map – SWMU 001x (WIPP-13)

14.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

14.2.2.1 Nature and Extent of Contamination

The TSD identified barium, chromium, lead, and thallium as potential constituents of concern for the mud pit materials in this SWMU. Concentrations of barium, chromium, and lead were detected at SWMU 001x by total metals analysis (Table 14.1). In addition, as defined in Appendix B, thallium has been eliminated as a constituent of concern for the SWMUs. Based on the information contained in Table 14.1, Appendix A, and Appendix B, the investigations will be implemented to define the extent of the barium, chromium, and lead concentrations above background. No other constituent will be investigated.

Table 14.1
Summary of Measured Concentrations for Constituents of Concern
SWMU 001x (WIPP-13)

Description	Hole #	Depth (in. bgs)	Constituent	Concentration (ppm)	Qualifier
WIPP-13 Drilling Mud Pits	1	12 to 24	Barium	10	
			Chromium	3	
			Lead	1.6	
		60 to 72	Barium	12	
			Chromium	4	
			Lead	1.5	
	2	12 to 24	Barium	13	
			Chromium	6	
			Lead	1.3	
		60 to 72	Barium	17	
			Chromium	13	
			Lead	1.7	
	3	12 to 24	Barium	16	
			Chromium	7	
			Lead	1.8	
		60 to 72	Barium	40	
			Chromium	8	
			Lead	2.8	
	4	12 to 24	Barium	3800	
			Chromium	36	
			Lead	270	
		60 to 72	Barium	680	
			Chromium	10	
			Lead	15	

Notes:
Background concentration for chromium = 26 ppm
Background concentrations for lead = 5.4 ppm
Background concentrations for barium = 170 ppm
ppm = parts per million
in. bgs = inches below ground surface
SWMU = Solid Waste Management Unit

14.2.2.2 Fate and Transport

The depth to proven groundwater below SWMU 001x is at least 700 feet, and it is estimated that less than 0.5 inch of precipitation per year infiltrates the underlying strata. Thus, the potential for these metals to migrate to groundwater is extremely low. The mud pit material has been covered with native soil excavated from the mud pit, so there is no possibility for surface water or wind transport of mud pit material. Furthermore, because the land has been withdrawn from public use and the potential for intrusive activities is low, the potential exposure of human receptors to metals in the SWMU is minimal to nonexistent.

14.2.2.3 Data Gaps

Additional data will be collected as described in section 14.2.3 below.

14.2.3 Sampling Activities

The proposed scope of work at SWMU 001x includes the collection of subsurface soil samples at two locations within the SWMU boundary by means of direct push (or comparable) methodology. One additional location outside of the SWMU boundary will be sampled to further define the extent of contamination.

14.2.3.1 Contaminant Source

The area to be further investigated is the abandoned mud pit from the drilling of WIPP-13 that comprises the 001x SWMU site. Soil sampling activities will be focused on the north end of the mud pit outside of the drill pad. At each sampling location, one subsurface soil sample will be collected from a two-foot interval within the drilling mud, and one sample will be collected from a 12- to 24-inch interval below the drilling mud/soil interface. The approximate locations for proposed sampling are represented in Figure 14.1.

14.2.3.2 Media Characterization

All soil samples collected will be shipped in split spoon soil liners (or equivalent containers) to a WIPP approved laboratory and analyzed for barium, chromium, and lead by EPA SW-846 Methods 6010A or 7000 as appropriate (EPA, 1997). Prior to analysis, the laboratory will homogenize the soil from the liner in each sampling interval to obtain a representative sample for each vertical interval. The process will be described in the appropriate laboratory SOP. The remaining portion of that sample will be archived.

15.0 SWMU 004a (PORTACAMP STORAGE YARD, WEST SIDE)

The following subsections discuss the investigation, characterization, setting and field investigation activities that have been and will be conducted at SWMU 004a.

15.1 Characterization and Setting

SWMU 004a, the Portacamp Storage Yard, is an active materials storage area located in the E ½ of the NE ¼ of the NE ¼ of Section 29, Township 22 south, Range 31 east. The Portacamp Storage Area is primarily designed to store new parts and materials such as drums, pipe, and equipment. The Portacamp is also used to store and manage used hydraulic oil, used motor oil, used antifreeze, and discontinued oils prior to recycling or disposal at offsite facilities.

15.1.1 Site Description

The 300 by 300 foot storage complex is surrounded by a locked, eight-foot chain-link fence. This complex is also divided into two separately managed areas divided by an eight-foot, chain-link fence. The west side of the Portacamp area is managed by Westinghouse, and the east side is managed by Sandia National Laboratories. Access to each area is limited to Westinghouse and Sandia materials control personnel, and the area is regularly patrolled by WIPP security.

The west side of the Portacamp storage yard contains a 100-foot long by 20-foot wide by 14-foot high open-sided metal shed located in the southwest corner of the compound.

15.1.2 Operational History

Stored beneath the shed located in the southwest corner are new hazardous waste handling containers; operational and maintenance equipment; an electric transformer substation; and used oils and lubricants. Beginning in 1995, all used oils scheduled for recycling at an offsite facility were stored on spill control pallets under the metal shelter.

The southern half of the Westinghouse Portacamp area is used to store construction and maintenance materials such as steel stock, pipe, fencing materials, and mining timbers. The north central area was historically used as a holding area for nonhazardous waste waters and non-RCRA regulated oils awaiting appropriate disposal or reclamation. Labeled nonhazardous waste drums were historically stored on wooden pallets, which sat directly on the caliche pad. The site inspection revealed four small areas of surface discoloration on the caliche pad in and around the empty nonhazardous waste drum storage area. Digging in the area of the stained soil indicates that soil discoloration is confined to the top 6 to 8 inches of caliche, and the largest stain is approximately three feet in diameter.

15.1.3 Waste Characterization

Equipment and nonhazardous and hazardous materials and wastes have been managed in the Portacamp area since 1976. WIPP began formalized management of hazardous materials and hazardous wastes in 1988. WIPP has developed procedures that provide specific guidance for the management of hazardous wastes generated at the WIPP, as well as the identifying spill response and spill remediation requirements at the site.

Beginning in 1991, all RCRA regulated wastes were managed in the WIPP Hazardous Waste Storage Area (Building 474-B). Used oil that contains one or more hazardous constituents is managed at the Hazardous Waste Staging Area located in Building 474-B.

15.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

15.2.1 Existing Data

The following subsections describe data that were collected for SWMU 004a.

15.2.1.1 Nonsampling

No nonsampling activities were performed at this SWMU.

15.2.1.2 Sampling

During a summer 1995 sampling event at SWMU 004a, a total of 26 soil boring samples and 6 associated QA/QC samples were collected for TCLP metals analysis to assess the potential for release of hazardous constituents from the SWMU. Soil sampling locations at the SWMU were sampled again in the summer of 1996. During the summer 1996 sampling event, 26 soil boring samples and 2 associated QA/QC samples were collected for total constituent analysis to further characterize the vertical and horizontal extent of any potential release of hazardous constituents from SWMU 004a.

Samples were collected in the Portacamp Storage Yard as well as in the Sandia Portacamp Yard. Sampling at the Westinghouse Portacamp and Sandia Portacamp areas focused on both current and historic waste and material storage areas. Sampling in the Sandia Portacamp area also focused on the area where drilling additives are stored.

Grab samples were collected from the top 48 inches of the compacted caliche surface. Samples were collected from the 12- to 24-inch depth to characterize the area of maximum potential contamination at the Portacamp Storage Yard. The samples collected from a 36- to 48-inch depth were designed to characterize the vertical extent of any potential release onto the compacted caliche storage pad. Additional samples were planned if stained soils were visible at the 48-inch sampling depth. During the Portacamp Storage Yard sampling visit, no stained or discolored soils were encountered. Figure 15.1 is a site map showing sample locations and chromium, lead, and methanol concentrations for sample locations at SWMU 004a.

15.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

15.2.2.1 Nature and Extent of Contamination

The TSD identified chromium, lead, methanol, nickel, and thallium as potential constituents of concern for the mud pit materials in this SWMU. Concentrations of chromium, methanol, and nickel were detected above background at SWMU 004a by total metals analysis (Table 15.1). Total metals concentrations of lead measured in SWMU 004a are below the lead background concentration (Table 15.1 and Appendix A). In addition, as defined in Appendix B, thallium has been eliminated as a constituent of concern for the SWMUs. Based on the information contained in Table 15.1, Appendix A, and Appendix B, the investigations will be implemented to define the extent of the chromium, methanol, and nickel concentrations above background. No other constituent will be investigated.

Table 15.1
Summary of Measured Concentrations for Constituents of Concern
SWMU 004a (Portacamp Storage Yard)

Description	Hole #	Depth (in. bgs)	Constituent	Concentration (ppm)	Qualifier
Portacamp Storage Yard	1	12 to 24	Chromium	15	
			Nickel	6	
			Methanol	2	U
		60 to 72	Chromium	25	
			Nickel	12	
			Methanol	2	U
	2	12 to 24	Chromium	4	
			Nickel	3	
			Methanol	2	U
		60 to 72	Chromium	8	
			Nickel	5	
			Methanol	2	U
	3	12 to 24	Chromium	50	
			Nickel	22	
			Methanol	2	U
		60 to 72	Chromium	120	
			Nickel	54	
			Methanol	42	
	4	12 to 24	Chromium	140	
			Nickel	66	
			Methanol	200	
		60 to 72	Chromium	4	
			Nickel	2	U
			Methanol	200	
	5	12 to 24	Chromium	2	
			Nickel	2	U
			Methanol	2	U
		60 to 72	Chromium	4	
			Nickel	2	U
			Methanol	2	U

Notes:
Background concentration for chromium = 26 ppm
Background concentration for nickel = <2 ppm
Background concentration for methanol = <2 ppm
ppm = parts per million
in. bgs = inches below ground surface
SWMU = Solid Waste Management Unit
U = Analyte was not detected; value is the method reporting limit.

15.2.2.2 Fate and Transport

The depth to proven groundwater near SWMU 004a is at least 880 feet, and it is estimated that less than 0.5 inch of precipitation per year infiltrates the underlying strata. Thus, the potential for these metals to migrate to groundwater is extremely low. The site is covered with crushed caliche, so the potential for surface water or wind transport of constituents is low. Furthermore, because the land has been withdrawn from public use and the potential for intrusive activities is low, the potential exposure of human receptors (other than WIPP Portacamp workers) to metals in the SWMU is minimal to nonexistent.

15.2.2.3 Data Gaps

Additional data will be collected as described in section 15.2.3 below.

15.2.3 Sampling Activities

The proposed scope of work at SWMU 004a includes the collection of three subsurface soil samples within the SWMU boundary by means of direct push (or comparable) methodology. An additional soil sample will be collected outside of the SWMU boundary to further define the extent of contamination.

15.2.3.1 Contaminant Source

The area to be further investigated is the western edge of the SWMU boundary for the purpose of delineating the boundary of concentrations above background. The proposed scope of work for SWMU 004a includes the collection of soil samples from three locations: two locations within the SWMU, and one location outside of the SWMU to further define the extent of chromium, methanol, and nickel concentrations above background. At each location, two subsurface samples will be collected, one from a 12- to 24-inch interval below the ground surface, and the second from a 48- to 60-inch interval below the ground surface. The soil samples will be analyzed for total chromium, methanol, and nickel. The approximate locations for proposed sampling are represented in Figure 15.1.

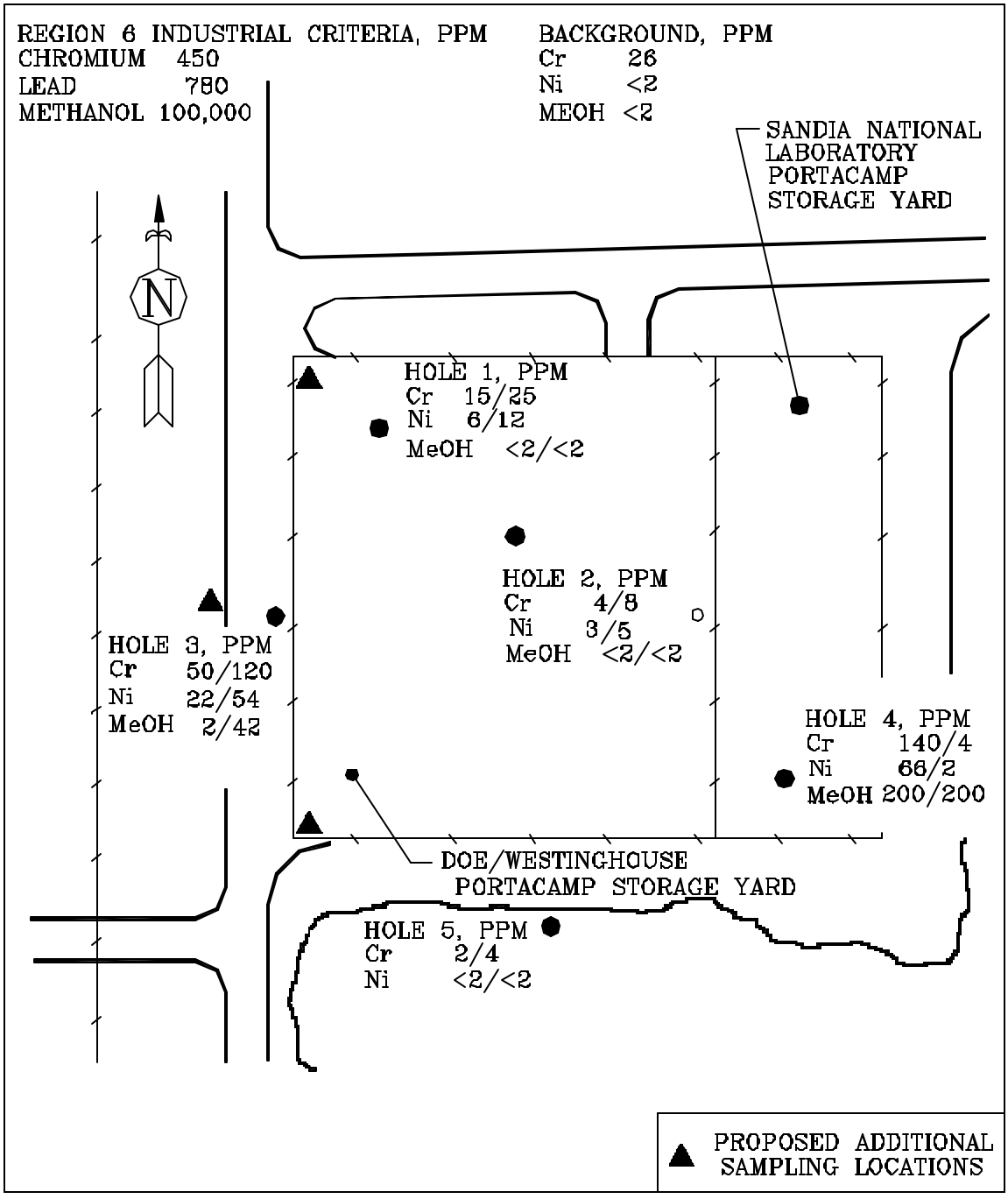

Figure 15.1 - Sample Location Map – SWMU 004a (Portacamp Storage Yard)

15.2.3.2 Media Characterization

All soil samples collected will be shipped in split spoon soil liners (or equivalent containers) to a WIPP approved laboratory and analyzed for total chromium, methanol, nickel by EPA SW-846 Methods 6010B or 8015A, as appropriate. The laboratory will homogenize the soil from one liner to obtain a representative sample for each vertical interval. The process will be described in the appropriate laboratory SOP. The remaining portion of that sample will be archived.

16.0 SWMU 007b (SW EVAPORATION POND)

The following subsections discuss the characterization and setting and field investigation activities that have been and will be conducted at SWMU 007b.

16.1 Characterization and Setting

SWMU 007b is a former evaporation pond located on the WIPP facility adjacent to building 474.

16.1.1 Site Description

SWMU 007b is estimated as an approximate 145 feet by 145 feet area located approximately 770 feet due west of the WIPP Waste Handling Building. The location of SWMU 007b, now completely graded, lies within an area that receives stormwater and domestic water resulting from fire flow performance testing.

16.1.2 Operational History

During construction of the facility (late 1983 to early 1984), the evaporation pond received water from personnel showers.

16.1.3 Waste Characterization

The evaporation pond received only water from personnel showers (grey water), and analytical results for the grey water are not available.

16.2 Investigatory Approach

The following subsections describe previous sampling activities that have been conducted at the site and identify investigation activities to be conducted.

16.2.1 Existing Data

The following subsections describe data that were collected at SWMU 007b.

16.2.1.1 Nonsampling

No nonsampling activities were completed at this SWMU.

16.2.1.2 Sampling

SWMU 007b was sampled as part of the RFA. WIPP collected one investigative sample and one background sample in 1992 as part of that investigation. NMED also collected an investigative sample at the site during that time. Figure 16.1 is a site map showing sample locations and lead and nickel concentrations at SWMU 007b.

16.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this SWMU.

16.2.2.1 Nature and Extent of Contamination

The TSD identified lead and nickel as constituents of potential concern for this SWMU. Concentrations of lead and nickel were detected above background at SWMU 007b by total metals analyses.

Table 16.1
Summary of Measured Concentrations for Constituents of Concern
SWMU 007b (SW Evaporation Pond)

Description	Hole #	Depth (in. bgs)	Constituent	Concentration (ppm)	Qualifier
SW Evaporation Pond	A (1)	12 to 24	Lead	6	
			Nickel	5	
		60 to 72	Lead	6	
			Nickel	4	
	A (2)	12 to 24	Nickel	7	
		60 to 72	Nickel	-	

Notes:
Background concentration for Nickel = <2 ppm
Background concentration for Lead = 5.4 ppm
(1) Sampled by DOE 10/92
(2) Sampled by NMED 10/92

NMED = New Mexico Environment Department
ppm = parts per million
in. bgs = inches below ground surface.
SWMU = Solid Waste Management Unit

16.2.2.2 Fate and Transport

The former location of SWMU 007b, now completely graded, lies within an area that receives stormwater and domestic water resulting from fire flow performance testing. The stormwater retention basin is bermed on all four sides and has been completely revegetated. The depth to proven groundwater near SWMU 007b is at least 880 feet, and it is estimated that less than 0.5 inches of precipitation per year infiltrates the underlying strata. Thus, the potential for these metals to migrate to groundwater is extremely low. The site is covered with vegetation, so the potential for surface water or wind transport of constituents is low. Furthermore, because the land has been withdrawn from public use and the potential for intrusive activities is low, the potential exposure of human receptors to metals in the SWMU is minimal to nonexistent.

16.2.2.3 Data Gaps

Additional data will be collected as described in section 16.2.3 below.

16.2.3 Sampling Activities

The proposed scope of work at SWMU 007b includes the collection of two shallow subsurface soil samples within the SWMU boundary by means of direct push (or comparable) methodology. An additional soil sample will be collected outside of the SWMU boundary to further define the extent of contamination.

16.2.3.1 Contaminant Source

The approximate locations for proposed sampling are represented in Figure 16.1. At each sampling location, one soil sample will be collected. The soil sample will be collected from a 12- to 24-inch interval below ground surface.

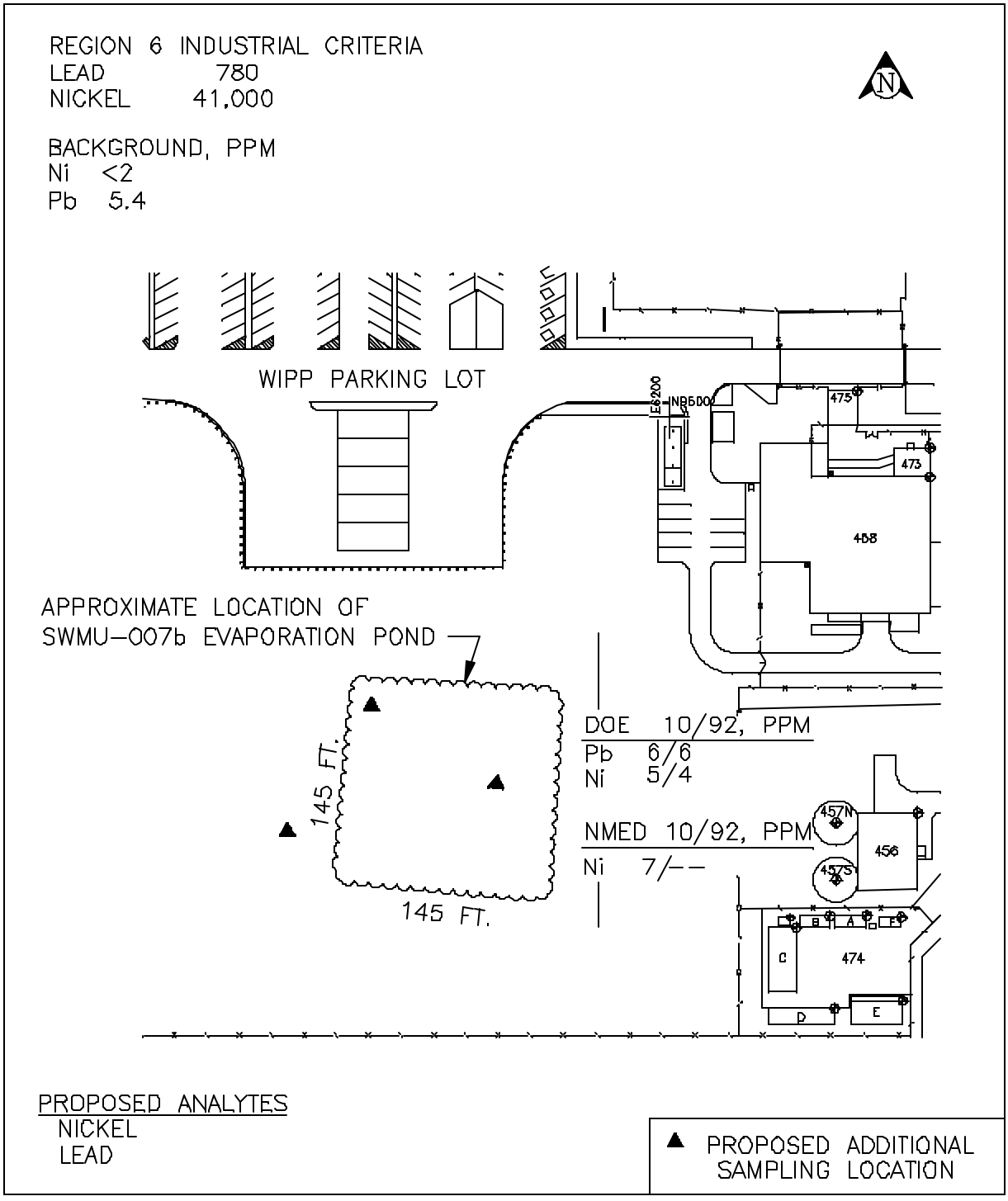

Figure 16.1 - Sample Location Map – SWMU 007b (SW Evaporation Pond)

16.2.3.2 Media Characterization

All soil samples collected will be shipped in split spoon soil liners (or equivalent containers) to a WIPP approved laboratory and analyzed for nickel, and lead by EPA SW-846 Method 6010B. The laboratory will homogenize the soil from one liner to obtain a representative sample for the vertical interval. The process will be described in the appropriate laboratory SOP. The remaining portion of the samples will be archived.

17.0 AOC 001r (D-123 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that will be conducted at AOC 001r.

17.1 Characterization and Setting

AOC 001r is located in the NE ¼ of the SE ¼ of Section 34, Township 22 south, Range 31 east. The abandoned mud pit constructed for the drilling of borehole D-123 is AOC 001r.

17.1.1 Site Description

AOC 001r is covered with dune sand and accommodates a livestock watering tank. No mud pit liners or stained soil are evident. The mud pit is located in the southeaster portion of the cleared area and has approximate dimensions of 8 feet by 16 feet.

17.1.2 Operational History

Borehole D-123 was completed by the Weaver Drilling Company on behalf of the Duval Sulpher and Potash Company in August, 1953. The hole was drilled to a total depth of 1,880 feet, with coring efforts commencing at 932 feet below ground surface. The Weaver Drilling Company used a Sullivan 200-A core drill, pulling 31 feet of drill rods and coring with a 22 foot core barrel and a 3-13/16-inch diamond bit.

The borehole was abandoned using 73 sacks of cement mixed with 3 percent calcium chloride and brine at the bottom of the hole. 45 sacks of cement mixed with fresh water bottomed at 880 feet bgs, and the remainder of the hole was filled with cuttings to ground surface. The D-123 site was closed by the USGS in 1953.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells.

Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

17.1.3 Waste Characterization

The principal drilling materials used for the drilling of hole D-123 were saturated brine and mud.

17.2 Investigatory Approach

No investigations have occurred at this AOC.

17.2.1 Existing Data

This section is not applicable.

17.2.1.1 Nonsampling

This section is not applicable.

17.2.1.2 Sampling

This section is not applicable.

17.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this AOC.

17.2.2.1 Nature and Extent of Contamination

This site was closed by the USGS in 1953. Consequently, no investigations will be conducted at this AOC.

17.2.2.2 Fate and Transport

This section is not applicable.

17.2.2.3 Data Gaps

No data gaps exist for this AOC.

17.2.3 Sampling Activities

No samples will be collected at this AOC.

17.2.3.1 Contaminant Source

This section is not applicable.

17.2.3.2 Media Characterization

This section is not applicable.

18.0 AOC 001u (IMC-376 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that will be conducted at AOC 001u.

18.1 Characterization and Setting

AOC 001u is located in the NW ¼ of Section 20, Township 22 south, Range 31 east. The abandoned mud pit constructed for the drilling of borehole number IMC-376 is AOC 001u.

18.1.1 Site Description

The drill pad for IMC-376 appears to be relatively clean and well reclaimed. A zone of discolored soil and sparse vegetation in the northwestern portion of the drill pad represents the location of the approximately 12- by 24-foot mud pit.

18.1.2 Operational History

Borehole IMC-376 was drilled by the Boyles Brothers Drilling Company on behalf of the International Minerals and Chemicals Corporation in June, 1965 as a potash exploration borehole. IMC-376 was drilled to a total depth of 1,702 feet below ground surface. The borehole was abandoned with cement and mud. The IMC-376 site was closed by the USGS in 1965.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

18.1.3 Waste Characterization

The principal drilling materials used for the drilling of hole IMC-376 were saturated brine and air.

18.2 Investigatory Approach

No investigations have occurred at this AOC.

18.2.1 Existing Data

This section is not applicable.

18.2.1.1 Nonsampling

This section is not applicable.

18.2.1.2 Sampling

This section is not applicable.

18.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this AOC.

18.2.2.1 Nature and Extent of Contamination

This site was closed by the USGS in 1953. Consequently, no additional investigations will be conducted at this AOC.

18.2.2.2 Fate and Transport

This section is not applicable.

18.2.2.3 Data Gaps

No data gaps exist for this AOC.

18.2.3 Sampling Activities

No samples will be collected at this AOC.

18.2.3.1 Contaminant Source

This section is not applicable.

18.2.3.2 Media Characterization

This section is not applicable.

19.0 AOC 001v (IMC-456 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that will be conducted at AOC 001v.

19.1 Characterization and Setting

AOC 001v is located in the SW ¼ of Section 22, Township 22 south, Range 31 east. The abandoned mud pit constructed for the drilling of borehole number IMC-456 is AOC 001v.

19.1.1 Site Description

The drill pad for IMC-456 is relatively clean and well reclaimed. A zone of discolored soil and sparse vegetation in the northern portion of the drill pad represents the location of the approximately 8- by 21-foot mud pit.

19.1.2 Operational History

Borehole IMC-456 was drilled by the Boyles Brothers Drilling Company on behalf of the International Minerals and Chemicals Corporation in July 1976 as a potash exploration borehole. IMC-456 was drilled to a total depth of 1,975 feet below ground surface. The borehole was abandoned with cement. The IMC-456 site was closed by the USGS in 1976.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

19.1.3 Waste Characterization

The principal drilling material used for the drilling of hole IMC-456 was saturated brine.

19.2 Investigatory Approach

No investigations have occurred at this AOC.

19.2.1 Existing Data

This section is not applicable.

19.2.1.1 Nonsampling

This section is not applicable.

19.2.1.2 Sampling

This section is not applicable.

19.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this AOC.

19.2.2.1 Nature and Extent of Contamination

This site was closed by the USGS in 1976. Consequently, no additional investigations will be conducted at this SWMU.

19.2.2.2 Fate and Transport

This section is not applicable.

19.2.2.3 Data Gaps

No data gaps exist for this AOC.

19.2.3 Sampling Activities

No samples will be collected at this AOC.

19.2.3.1 Contaminant Source

This section is not applicable.

19.2.3.2 Media Characterization

This section is not applicable.

20.0 AOC 001w (IMC-457 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that will be conducted at AOC 001w.

20.1 Characterization and Setting

AOC 001w is located in the SW ¼ of Section 27, Township 22 south, Range 31 east. The abandoned mud pit constructed for the drilling of borehole number IMC-457 is AOC 001w.

20.1.1 Site Description

The drill pad for IMC-457 is built up about 0.3 meters above the natural terrain. A zone of discolored soil and sparse vegetation in the northwestern portion of the drill pad represents the location of the approximately 8 feet by 18 feet mud pit.

20.1.2 Operational History

Borehole IMC-457 was drilled by the Boyles Brothers Drilling Company on behalf of the International Minerals and Chemicals Corporation in July, 1976 as a potash exploration borehole. IMC-457 was drilled to a total depth of 1,885 feet below ground surface. The borehole was abandoned with cement. The IMC-457 site was closed by the USGS in 1976.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

20.1.3 Waste Characterization

The principal drilling material used for the drilling of hole IMC-457 was saturated brine.

20.2 Investigatory Approach

No investigations have occurred at this AOC.

20.2.1 Existing Data

This section is not applicable.

20.2.1.1 Nonsampling

This section is not applicable.

20.2.1.3 Sampling

This section is not applicable.

20.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this AOC.

20.2.2.1 Nature and Extent of Contamination

This site was closed by the USGS in 1976. Consequently, no additional investigations will be conducted at this AOC.

20.2.2.2 Fate and Transport

This section is not applicable.

20.2.2.3 Data Gaps

No data gaps exist for this AOC.

20.2.3 Sampling Activities

No samples will be collected at this AOC.

20.2.3.1 Contaminant Source

This section is not applicable.

20.2.3.2 Media Characterization

This section is not applicable.

21.0 AOC 001ac (DSP-207 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that will be conducted at AOC 001ac.

21.1 Characterization and Setting

AOC 001ac is located in the SW ¼ of the NE ¼ of the SW ¼ Section 19, Township 22 south, Range 31 east. The abandoned mud pit constructed for the drilling of borehole number DSP-207 is AOC 001ac.

21.1.1 Site Description

The drill pad for DSP-207 is sparsely vegetated and appears to have been regraded. A zone of discolored soil and sparse vegetation in the southern portion of the drill pad represents the location of the approximately 8 feet by 18 feet mud pit.

21.1.2 Operational History

Borehole DSP-207 was drilled by the Joy Drilling Company on behalf of the Duval Sulpher and Potash Company in June 1958 as a potash exploration borehole. DSP-207 was drilled to a total depth of 1,613 feet below ground surface. The borehole was abandoned with cement. The DSP-207 site was closed by the USGS in 1958.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

21.1.3 Waste Characterization

The principal drilling material used for the drilling of hole DSP-207 was saturated brine and drilling mud.

21.2 Investigatory Approach

No investigations have occurred at this AOC.

21.2.1 Existing Data

This section is not applicable.

21.2.1.1 Nonsampling

This section is not applicable.

21.2.1.2 Sampling

This section is not applicable.

21.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this AOC.

21.2.2.1 Nature and Extent of Contamination

This site was closed by the USGS in 1958. Consequently, no additional investigations will be conducted at this AOC.

21.2.2.2 Fate and Transport

This section is not applicable.

21.2.2.3 Data Gaps

No data gaps exist for this AOC.

21.2.3 Sampling Activities

No samples will be collected at this AOC.

21.2.3.1 Contaminant Source

This section is not applicable.

21.2.3.2 Media Characterization

This section is not applicable.

22.0 AOC 001ae (IMC-377 MUD PIT)

The following subsections discuss the characterization and setting and field investigation activities that will be conducted at AOC 001ae.

22.1 Characterization and Setting

AOC 001ae is located in the NW ¼ of the NW ¼ of Section 22, Township 22 south, Range 31 east. The abandoned mud pit constructed for the drilling of borehole number IMC-377 is AOC 001ae.

22.1.1 Site Description

The drill pad for IMC-377 is sparsely vegetated and appears to have been regraded. A zone of depressed in the northeastern portion of the drill pad represents the location of the approximately 8 foot by 16 foot mud pit.

22.1.2 Operational History

Borehole IMC-377 was drilled by the Boyles Brothers Drilling Company on behalf of the International Minerals and Chemicals Corporation in July, 1965 as a potash exploration borehole. IMC-377 was drilled to a total depth of 1,876 feet below ground surface. The borehole was abandoned with cement. The site IMC-377 site was closed by the USGS in 1965.

The USGS Conservation Division was the approval authority for potash exploration boreholes drilled during the period 1953 through 1978 in Eddy County, New Mexico. During this period, the USGS administered the drilling programs under the authority granted by the U.S. Congress.

The USGS permitted private exploration boreholes, which were drilled by mineral leaseholders. The USGS received and approved Sundry Notices and Reports on Wells. Prior to drilling a borehole, the company submitted a Notice of Intention to Drill for approval by the USGS. Following completion of the drilling and closure of the drilling location, the company notified the USGS of its intention to abandon the site. Upon approval of the notice, the USGS considered the drilling location closed. No additional closure documentation was required.

The USGS approved the closure and abandonment of the drilling sites according to then current requirements. The permitting and closure activities for potash exploration were

established by the USGS in the early 1950's. These activities have not changed substantially since that time, as evidenced by recent permits being granted by the BLM.

22.1.3 Waste Characterization

The principal drilling materials used for the drilling of hole IMC-377 was saturated brine.

22.2 Investigatory Approach

No investigations have taken place associated with this AOC.

22.2.1 Existing Data

This section is not applicable.

22.2.1.1 Nonsampling

This section is not applicable.

22.2.1.2 Sampling

This section is not applicable.

22.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this AOC.

22.2.2.1 Nature and Extent of Contamination

This site was closed by the USGS in 1965. Consequently, no additional investigations will be conducted at this AOC.

22.2.2.2 Fate and Transport

This section is not applicable.

22.2.2.3 Data Gaps

No data gaps exist for this AOC.

22.2.3 Sampling Activities

No samples will be collected at this AOC.

22.2.3.1 Contaminant Source

This section is not applicable.

22.2.3.2 Media Characterization

This section is not applicable.

23.0 AOC 010b (WASTE HANDLING SHAFT SUMP)

The following subsections discuss the characterization and setting and field investigation activities that will be conducted at AOC 010b.

23.1 Characterization and Setting

AOC 010b is located at S400/E300 at the bottom of the Waste Handling Shaft, approximately 2,269 feet below ground surface.

23.1.1 Site Description

The diameter of the Waste Handling Shaft is 20 feet and extends 119 feet below the facility horizon to accommodate the hoist counter weights. The unlined sump at the bottom of this shaft is AOC 010b.

23.1.2 Operational History

The Waste Handling Shaft is the route of entry for waste to be disposed in the HWDUs. The shaft is part of the operation of the facility and will continue to be used until the facility is closed in the future.

23.1.3 Waste Characterization

Waste reportedly accumulated in the AOC during the construction phase of the facility included: cement grout, chemical grout, grease, and other construction debris. All of these wastes have been removed from the sump.

Brine has been observed in the sump. Sampling of the brine indicated some of it contained elevated levels of lead. The brine, as it flows down the exhaust shaft, leaches lead from chain-link mesh attached to the exhaust shaft. The lead-containing brine is currently managed and disposed of at an off-site treatment, storage, and disposal facility. The installation of a catchment basin at the base of the exhaust shaft has prevented any new flow of brine to the Waste Handling Shaft.

23.2 Investigatory Approach

No investigations have occurred at this AOC.

23.2.1 Existing Data

This section is not applicable.

23.2.1.1 Nonsampling

This section is not applicable.

23.2.1.2 Sampling

This section is not applicable.

23.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this AOC.

23.2.2.1 Nature and Extent of Contamination

The TSD does not identify any specific constituents of potential concern for this AOC, although lead is discussed. Any lead that may have leached from the brine remains in the salt of the repository.

23.2.2.2 Fate and Transport

Because any lead in the brine is located at least 2,150 feet below ground surface, in a facility that contains no ground water, there is no possibility that the lead will be transported beyond the facility. In addition, because the sump is located well below ground, there is no complete exposure pathway for human or environmental receptors.

There was no release of hazardous constituents to the environment, because there is no complete exposure pathway. In addition, the sump will be closed at the end of operations, ensuring that there will be no complete exposure pathway in the future. Consequently, this AOC does not require any additional investigation.

23.2.2.3 Data Gaps

No additional data will be collected.

23.2.3 Sampling Activities

No sampling activities will be conducted.

23.2.3.1 Contaminant Source

This section is not applicable.

23.2.3.2 Media Characterization

This section is not applicable.

24.0 AOC 010c (EXHAUST SHAFT SUMP)

The following subsections discuss the characterization and setting and field investigation activities that will be conducted at AOC 010c.

24.1 Characterization and Setting

AOC 010c is located at S400/E480 at the bottom of the Exhaust Shaft, approximately 2,150 feet below ground surface.

24.1.1 Site Description

The diameter of the Exhaust Shaft is 18 feet and ends at the facility horizon. The unlined sump at the bottom of this shaft is AOC 010c.

24.1.2 Operational History

The Exhaust Shaft is the main ventilation exhaust route for the underground facility. The shaft is part of the operation of the facility and will continue to be used until the facility is closed in the future.

24.1.3 Waste Characterization

Waste reportedly accumulated in the AOC during the construction phase of the facility included: cement grout, chemical grout, grease, and other construction debris. All of these wastes have been removed from the sump.

Brine has been observed in the sump. Sampling of the brine indicated some of it contained elevated levels of lead. The source of the increased brine flow was traced to water condensing in the Exhaust Shaft. The brine, as it flows down the exhaust shaft, leaches lead from chain-link mesh attached to the exhaust shaft. The lead-containing brine is currently managed and disposed of at an off-site treatment, storage, and disposal

facility. A catchment basin has been installed at the base of the exhaust shaft to collect the brine.

24.2 Investigatory Approach

No investigations have occurred at this AOC.

24.2.1 Existing Data

This section is not applicable.

24.2.1.1 Nonsampling

This section is not applicable.

24.2.1.2 Sampling

This section is not applicable.

24.2.2 Conceptual Model

The following subsections define various aspects of the conceptual model developed for this AOC.

24.2.2.1 Nature and Extent of Contamination

The TSD does not identify any specific constituents of potential concern for this AOC, although lead is discussed. Any lead that may have been deposited from the brine remains in the salt of the repository.

24.2.2.2 Fate and Transport

Because any lead in the brine is located at least 2,150 feet below ground surface, in a facility that contains no circulating ground water, as demonstrated by the numerical modeling submitted with the permit application, the possibility that the lead will be transported beyond the facility is insignificant. In addition, because the sump is located deep underground, there is no complete exposure pathway for human or environmental receptors.

There was no release of hazardous constituents to the environment, because there is no complete exposure pathway. In addition, the sump will be closed at the end of operations, ensuring that there will be to complete exposure pathway in the future. Consequently, this AOC does not require any additional investigation.

24.2.2.3 Data Gaps

No additional data will be collected.

24.2.3 Sampling Activities

No sampling activities will be conducted.

24.2.3.1 Contaminant Source

This section is not applicable.

24.2.3.2 Media Characterization

This section is not applicable.

25.0 DATA COLLECTION DESIGN AND PROCEDURES

General elements of the data collection design and procedures, including data quality objectives, QA/QC of sampling and analysis, and field activities are described in the following subsection.

25.1 Data Quality Objectives

Data quality objectives for the investigation were previously described in section 1.4. Data quality objectives are qualitative and quantitative statements that specify the quality of the data required to support decisions made during corrective action activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. There are two levels of analytical data quality currently defined by EPA that address different data needs and thus have different associated levels of confidence and QA/QC. These levels are:

Screening Data: Generated by rapid, low precision methods of analysis, or untested methods of analysis, usually in the field, with minimal sample processing and preparation. Screening-level data are used in efforts that require only a qualitative assessment. The use of screening-level methods will be documented and technically sound. Screening data provide presumptive evidence of the presence of target analytes and estimated quantification of these analytes. Results produced are used to evaluate and select options for future work. The documentation generated during the screening-level analyses must withstand a technical review. However, in situations where a scientifically defensible data package is required, a percentage of the screening data points must be confirmed using definitive methods to support programmatic decisions made based on such results.

Definitive Data: Generated using rigorous analytical methods and QA protocols in environmental analytical laboratories. Definitive data provide reliable, well-documented identification, quantification, and confirmation of target analytes. Definitive data will generally be required for decisions regarding risk and/or the implementation of corrective measures. The results generated from definitive analyses must be scientifically defensible data that can prove or disprove a hypothesis with no additional information beyond that provided in the data package.

For this SAP, definitive data will be collected. Definitive data will be used to assess the extent of metals in SWMUs/AOCs at the site, and whether these metals have been released to the surrounding media at concentrations above decision criteria and/or performance standards.

25.2 Quality Assurance/Quality Control

Quality assurance and quality control (QA/QC) procedures to be followed during the SAP are intended to help ensure that the data collection, data evaluation and project reporting provide usable and defensible information. The QA/QC procedures for field activities, laboratory analyses and data management are described in the following subsections.

25.2.1 Quality Assurance/Quality Control Protocols for Sampling and Analysis

The Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling (WP 02-EC.05) establishes generalized QA/QC protocols for environmental sampling and analysis that will be followed during SAP activities. Procedures and requirements are established for the following:

- Sample documentation, handling, and shipping
- Sample custody
- Equipment calibration and maintenance
- Internal QC checks
- Preventative maintenance

The QA/QC procedures prescribed in the Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling (WP 02-EC.05) will be followed during the execution of the SAP fieldwork.

Quality assurance/quality control assessments and reviews will be performed by WID throughout the SAP. Assessment, review, and response actions will be performed in accordance with the established WIPP QA program as documented in the WID Quality Assurance Program Description (WP 13-1) and the Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling (WP 02-EC.05). Team members participating in SAP activities are collectively responsible for assessment activities, and have authority to implement corrective action or stop work depending on the situation.

25.2.2 Quality Assurance/Quality Control of Data Entry/Data Management

Analytical results received from the laboratory will be stored in a computer database. Accuracy and integrity of the project database are important for proper and efficient completion of the SAP. Accordingly, to ensure that database records are updated and analytical samples properly tracked QA/QC procedures will be implemented and the data management system periodically audited. Specifics regarding the QA/QC procedures for data entry and data management are provided in the Facility Work Plan (DOE, 2000).

25.2.3 Quality Assurance/Quality Control of Data Reporting Tools

To ensure that the data in the SAP report matches the information contained in the database, project personnel will compare standard data tabular reports, graphical output, and queries that are prepared to original hard copy results. Other tests may include comparisons of counts of certain data against expected totals.

25.3 Field Activities

For this investigation, only soil samples and associated aqueous equipment rinseate QC samples will be collected. The sampling design for individual SWMUs was specified in earlier sections. General procedures and requirements applicable to data collection activities are summarized below.

25.3.1 Sampling Procedures

Sampling procedures and field documentation protocols for SAP activities will be consistent with other sampling procedures that have been established at the WIPP site. These procedures are documented in the Characterization Sampling, Shipping, and Documentation (WP 02-EC1001), Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling (WP 02-EC.05) and WIPP Site Effluent and Hazardous Materials Sampling Plan (WP 02-EC.06). In addition to documenting the sampling procedures to be applied for various environmental and waste matrixes encountered at the WIPP site, these existing plans document protocols and requirements for the following:

- Field documentation practices
- Sample chain of custody
- Sample containers, preservation, and holding times
- Sample classification, handling, and shipping

25.3.2 Analytical Procedures

Contract analytical laboratories approved by WID shall perform sample analyses for the SAP. SAP analytical programs will be performed in accordance with the general

requirements and procedures set forth in the Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling (WP 02-EC.05). The specific target analytical parameters were presented in earlier sections for each SWMU.

Laboratory analytical methods for the SAP will be based on standard reference methods from *Test Methods for Evaluating Solid Wastes* (EPA-SW-846) (EPA, 1997b). The subcontract laboratory shall develop and maintain a set of written instructions, or SOPs, for performance of the reference methods. Each method SOP cites the specific reference method on which it is based (e.g., EPA Method 6010B for metals). The SOPs for the laboratory's analytical methods to be applied in support of the SAP activities shall be approved by the SWMU Project Manager for consistency with EPA method requirements and with program QA/QC objectives.

WID contractor laboratories will establish a statistical method detection limit (MDL) for organic and inorganic target analytes of interest using the procedures described in 40 CFR § 136, Appendix B (EPA, 1986). Method detection limits shall be verified at least annually. The MDL for the selected analytical methods will be developed by the laboratory and approved by the SWMU Project Manager before sample collection activities begin. At a level 3 to 10 times the MDL, the laboratory will establish a method reporting limit (MRL) for each target analyte in accordance with EPA SW-846 protocols. Where analytical technology allows, methods will be selected such that the predicted MRLS will be equal to or below the applicable decision criteria specified in the project-specific planning documents.

Method reporting limits for target analytes may be sample-specific for samples with complex sample matrices (i.e., samples containing one or more analytes at widely varying concentrations) or samples containing interferences. In these cases, MRLs will increase if a sample has to be diluted to provide on-scale instrument response for high-concentration analytes.

26.0 PROJECT MANAGEMENT

This section describes project management activities including project scheduling and reporting, health and safety, management of investigative derived waste and the community relations plan.

26.1 Project Scheduling and Reporting Requirements

The anticipated start date of this SAP will be 60 days after final NMED approval of this SAP. The duration of the field sampling activities will be approximately 30 calendar days.

A final report detailing results of the field activities will be submitted to NMED 90 days after receipt of validated laboratory analytical results.

Data collected during the SAP will be used to further evaluate the extent of elevated metal concentrations at each SWMU. Following completion of data evaluation, a draft SAP report will be prepared. This report will follow requirements provided in the Permit and will include descriptions of field activities and provide summaries of field and analytical results. The report will also include the results of the comparison of analytical results to background and risk screening values.

26.2 Health and Safety Plan

This section describes the Health and Safety Plan for the SAP activities. The health and safety program in place at WIPP meets or exceeds DOE, National Institute for Occupational Safety and Health, Occupational Safety and Health Administration, Mine Safety and Health Administration, and EPA requirements.

Safety assessments were completed during the Voluntary Release Assessment Program (DOE/WIPP 96-2209) and no chemical safety concerns were identified. The industrial safety concerns will be addressed by WID procedures and applicable job hazard analyses for proposed fieldwork. Substantial resources and documentation are available to develop these definitions and analyses. The WID Industrial Safety and Hygiene Section group provides assistance in defining hazards associated with particular activities and in defining appropriate safety precautions and personal protective equipment (PPE) for specific job assignments. Personal protection equipment for field activities during this SAP will be Level D.

Chapter F of the *RCRA Part B Permit Application* (DOE/WIPP 91-005, Revision 6) defines site access and security procedures. The RCRA Permit Contingency Plan and the WIPP Emergency Management Plan describe emergency management procedures that may be applicable to SAP activities.

Procedures for decontamination procedures, and requirements for environmental monitoring programs and other safety-related issues potentially applicable to the SAP activities as required by the Permit are contained in the following existing WID documents:

- Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling (WP 02-EC.05)
- WIPP Site Effluent and Hazardous Materials Sampling Plan (WP 02-EC.06)
- WIPP Chemical Hygiene Plan (WP 12-IH.01)
- WIPP Industrial Hygiene Program (WP 12-IH.02)
- Industrial Safety Program (WP 12-IS.01)

- Fire Prevention Program (WP 12-FP.01)

- Fire Prevention Program (WP 12-FP.01)

26.3 Investigation-Derived Waste Plan

This section describes the approach for managing investigation-derived waste (IDW). Available analytical results for soil samples collected from the SWMUs indicate that the samples were not hazardous. It is anticipated that samples collected during the Investigation also will not be hazardous. Soil cuttings generated at individual sampling locations will be returned as backfill to the area where the soil was removed. Waste PPE will be considered solid waste and disposed of accordingly.

26.4 Community Relations Plan

The community relations plan addresses issues relevant to the public regarding dissemination of information regarding SAP activities and results for the SWMUs/AOCs. The Permit includes the following requirements for community relations during SAP activities.

- Obtain an initial facility mailing list of interested persons and entities from NMED and update it semiannually
- Hold informal meetings, briefings and workshops as appropriate with the public and local officials
- Prepare and disseminate news releases, fact sheets, the SAP, investigative reports, Special Permit Conditions Reports, and publicly available quarterly progress reports
- Create public information repositories and reading rooms in Sante Fe, Albuquerque, and Carlsbad, New Mexico
- Update materials in the repositories and reading rooms as appropriate
- Prepare quarterly technical progress reports for the NMED
- Establish procedures for immediate notification of affected persons or entities which could be impacted by newly discovered off-site releases from the SWMUs/AOCs

Specifics regarding individual components of the Community Relations Plan are provided in the Facility Work Plan (DOE, 2000). In compliance with the Community Relations Plan,

pertinent documents including the SAP and subsequent Investigation Report will be submitted to established WIPP information repositories.

27.0 SUMMARY

Of the 15 SWMUs and 8 AOCs included in this SAP, 10 SWMUs and 8 AOCs will not require additional investigation. One SWMU was eliminated based on the recent sampling and analysis results for thallium presented in Appendix B (SWMU 001s). Two SWMUs were eliminated, because no release of hazardous constituents has occurred at one portion of the SWMU and the other portion was closed under another regulatory authority (SWMUs 001g, and 001h). Seven SWMUs were eliminated because they were closed under another regulatory authority (SWMUs 001j, 001k, 001o, 001p, 001m, 001n, and 001t). Six AOCs were eliminated because they were closed under another regulatory authority. Two AOCs were eliminated because there is no complete exposure pathway (AOC 010b, and 010c).

Sampling will be conducted at five SWMUs. One SWMU was retained because only a portion of the SWMU can be considered to have been closed under another authority (SWMU 001L). Four SWMUs were retained because they have not been closed. A summary of the status for each of the SWMUs and AOCs is presented in Table 27.1.

Table 27.1
Summary of SWMUs and AOCs Included in the SAP

SWMU/AOC	Collect Samples	Eliminate From SAP				SAP Section
		No Thallium	No Release	No Pathway	Closed Under Another Authority	
SWMU 001g			X		X	2.0
SWMU 001h			X		X	3.0
SWMU 001j					X	4.0
SWMU 001k					X	5.0
SWMU 001L	X*				X*	6.0
SWMU 001m					X	7.0
SWMU 001n					X	8.0
SWMU 001o					X	9.0
SWMU 001p					X	10.0
SWMU 001q	X					11.0
SWMU 001s		X				12.0
SWMU 001t					X	13.0
SWMU 001x	X					14.0
SWMU 004a	X					15.0
SWMU 007b	X					16.0
AOC 001r					X	17.0
AOC 001u					X	18.0
AOC 001v					X	19.0
AOC 001w					X	20.0
AOC 001ac					X	21.0
AOC 001ae					X	22.0
AOC 010b				X		23.0
AOC 010c				X		24.0

* - Samples will be collected at the WIPP-12 mud pit; P-5 closed by the USGS.

28.0 REFERENCES

40 CFR §§ 260-270: Environmental Protection Agency (EPA) Regulations Implementing the Resource Conservation and Recovery Act (RCRA)

20 NMAC 4.1, Hazardous Waste Management

New Mexico Environment Department, 1994. Assessment of Solid Waste Management Units at the Waste Isolation Pilot Plant, the WIPP RCRA Facility Assessment (RFA) (NMED/DOE/AIP 94/1), May.

New Mexico Environment Department, 1998. HRMB Standard Operating Procedures Manual, March.

New Mexico Environment Department, 1999a. Waste Isolation Pilot Plant Hazardous Waste Permit, NM4890139088-TSDF, October 27.

New Mexico Environment Department, 1999b. Technical Support Document, Exclusion/Inclusion of Solid Waste Management Units and Areas of Concern, Permit Module VII Corrective Action for Solid Waste Management Units. Waste Isolation Pilot Plant EPA No. NM4890139088. October.

U.S. Department of Energy, 1991. WIPP RCRA Part B Permit Application, DOE/WIPP 91-005, Revision 0.

U.S. Department of Energy, 1995. WIPP RCRA Part B Permit Application, DOE/WIPP 91-005, Revision 6.

U.S. Department of Energy, 1996. Final Voluntary Release Assessment/Corrective Action Report, DOE/WIPP 96-2209.

U.S. Department of Energy, 2000. Facility Work Plan for Solid Waste Management Units Waste Isolation Pilot Plant, DOE/WIPP-00-2001.

U.S. Environmental Protection Agency, 1986. Title 40, Appendix B to Part 136, Definition and Procedure for the Determination of the Method Detection Limit (integrated). June 30.

U.S. Environmental Protection Agency, 1987. Data Quality Objectives for Remedial Response Activities (Development Process): USEPA/540/G-87/003, Office of Emergency and Remedial Response, Washington, D.C., March.

U.S. Environmental Protection Agency, 1993. Data Quality Objectives Process for Superfund, Interim Final Guidance, September, EPA540-R-93-071.

U.S. Environmental Protection Agency, 1994. Guidance for the Data Quality Objectives Process. Quality Assurance Management Staff, Washington, D.C. EPA QA/G-4.

U.S. Environmental Protection Agency, 1997. Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods (SW-846).

U.S. Environmental Protection Agency, 1998. Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G-9. January.

U.S. Environmental Protection Agency, 1999.EPA Region 6 Human Health Medium-Specific Screening Levels. June.

WP 02-EC.05, Quality Assurance Project Plan for WIPP Site Effluent and Hazardous Materials Sampling, latest revision

WP 02-EC.06, WIPP Site Effluent and Hazardous Materials Sampling Plan, latest revision

WP 12-FP.01, Fire Protection Program, latest revision

WP 12-IH.01, WIPP Chemical Hygiene Plan, latest revision

WP 12-IH.02, WIPP Industrial Hygiene Program, latest revision

WP 12-IS.01, Industrial Safety Program, latest revision

WP 13-1, WID Quality Assurance Program Description, latest revision

APPENDIX A - STATISTICAL EVALUATION OF BACKGROUND METALS DATA

1.0 INTRODUCTION

As part of the Waste Isolation Pilot Plant (WIPP) Voluntary Release Assessment/ Corrective Action (RA/CA) Program (DOE, 1996), background soil samples were collected from areas outside of Solid Waste Management Units (SWMU) at WIPP. Because some of the target metals for the sampling occur naturally in soil, including the WIPP Land Withdrawal Area, it is necessary to distinguish metal concentrations that represent the potential for releases of metals from background concentrations of metals. This appendix describes the statistical methods used to evaluate background concentrations of metals and identifies appropriate metals background concentrations for the WIPP investigation.

As was described in the WIPP Voluntary RA/CA Report (DOE, 1996) background soil samples were collected from depths of 12 to 24 inches below ground surface (bgs) and deeper than 24 inches. Background soil samples were collected from shallow (12- to 24-inch bgs) and deeper soil intervals to correspond to investigative soil samples that were collected from shallow and deeper soil intervals. The background soil samples were submitted for analyses of total metals including barium, chromium, lead and mercury. For this statistical evaluation, the metal concentrations in soil samples collected from the shallow and deeper soil intervals were combined into one data set. The following paragraphs describe the approach and results of the statistical evaluation.

2.0 STATISTICAL EVALUATION APPROACH

The analytical results for the background soil samples were evaluated statistically. The general logic and statistical methods used in this analysis are consistent with the EPA guidance documents " Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities – Interim Final Guidance (EPA, 1989) and Addendum to the Interim Final Guidance" (EPA, 1992). Specific descriptions of the statistical methods and techniques can be found in these two documents. This guidance was developed for the analysis of groundwater sample analytical results; however, the statistical methods defined in the guidance are well-defined and are directly applicable to the background metals analysis results.

2.1 Summary Statistics

Background metal summary statistics for barium, chromium, lead and mercury were calculated using standard Excel statistical functions. For each metal, summary statistics included the maximum and minimum concentrations, average and geometric means, and standard deviation.

2.2 Background Statistics

The following paragraphs describe statistical analyses performed as part of the background statistics evaluation.

2.2.1 Wilcoxon Rank Sum Test

Approximately half of the background soil samples were collected from the shallow (12- to 24-inch) soil interval and half from the deeper soil interval. Prior to performing statistical evaluations the two sets of data for each metal were compared to each other to evaluate whether the concentrations of metals in the shallow soil intervals were statistically different from the metal concentrations in the deeper soil intervals. This comparison was performed using a Wilcoxon Rank Sum test. This test (EPA, 1992) identifies whether values in one group of samples (e.g shallow soil samples) are different (higher or lower concentrations) from the values in a second group of samples (deeper soil samples). This test was performed using equations provided in the EPA 1992 reference.

2.2.2 Evaluation of Data Distribution

The data distributions for barium, chromium, lead and were evaluated to identify whether the data should be treated as parametric (normal or lognormal distribution) or nonparametric (other distribution). For small data sets, EPA recommends that distributional testing be performed on the natural logarithms of the data to test for lognormal distribution. If the data are lognormally distributed, tests for normality can be performed with the logged data. If the data are not lognormally distributed, the tests can be performed on the original data to test for normality. If the data are neither lognormally or normally distributed, a nonparametric technique was used to identify background concentrations.

The normality testing was performed using statistical software developed by EPA for evaluation of data sets. The software (DataQUEST – EPA, 1997) includes modules for performance of the Shapiro-Wilk test for normality. This test is recommended for data sets with less than 50 observation to test the premise that data are normally or lognormally distributed.

2.2.3 Selection of Upper Tolerance Limits

For detection monitoring programs, compliance point samples are assumed to come from the same population as background samples, until significant evidence of contamination can be shown. To test this hypothesis, a 95 percent coverage tolerance limit can be constructed for the background data. Once the interval is constructed, results for compliance samples can be compared to the upper tolerance limit (UTL). The procedure for constructing the tolerance limit must consider the number of detected and nondetected

sample results, and the distribution of the background results (e.g. normal, lognormal or other).

When the number of nondetected values in a sample exceeds 50 percent or the data are not normally or lognormally distributed, it is not possible to calculate a UTL. EPA guidance recommends selecting the highest measured value as the UTL. The highest value is referred to as the nonparametric UTL.

For this evaluation, the number of nondetected values was less than 50 percent except for mercury for which the number of nondetected values exceeded 50 percent (Table A1). In addition, the distributions of the barium, chromium, lead and mercury data were unknown. Consequently, the value representing the background concentrations of barium, chromium, lead and mercury were their respective nonparametric UTLs.

3.0 RESULTS OF THE STATISTICAL EVALUATION

Table A.1 presents the background analytical results for barium, chromium, lead and mercury. Also included in the table are summary statistics and background statistics. The following results are based on the information provided in Table A.1.

- Based on the distributional testing, the concentrations of barium, chromium, lead and mercury were neither normal nor lognormally distributed.

- The nonparametric UTL was selected to represent background concentrations of metals. The nonparametric UTL values were 170 mg/kg (barium), 26 mg/kg (chromium), 5.4 mg/kg (lead) and 0.06 mg/kg (mercury).

4.0 SUMMARY

A statistical evaluation of metals concentrations in background soil samples was performed. The statistical evaluation resulted in the identification of nonparametric UTLs. The nonparametric UTLs will be used for comparison to concentrations of barium, chromium, lead and mercury in investigative soil samples collected from SWMUs at the WIPP site. Results that are less than their respective background metal concentrations will be interpreted to indicate that no release has occurred. Conversely, values that exceed their respective background metal concentrations may identify a potential release.

5.0 REFERENCES

U.S. Department of Energy, 1996. Final Voluntary Release Assessment/Corrective Action Report, Waste Isolation Pilot Plant, Carlsbad, New Mexico. November.

U.S. Environmental Protection Agency, 1989. Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities – Interim Final Guidance

U.S. Environmental Protection Agency, 1992. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Addendum to the Interim Final Guidance. July.

U.S. Environmental Protection Agency, 1997. Data Quality Evaluation Statistical Toolbox (DataQUEST) User's Guide. December.

TABLE A.1 - WIPP COMBINED BACKGROUND METAL CONCENTRATIONS

SWMU	Hole	Location	Barium		Chromium		Lead		Mercury	
001g	1	H-14	15		3		1.9	J	0.01	UJ
001g	1	Mud Pit P-1	35		5		2.1	J	0.01	U
001g	2	Mud Pit P-1	39		3		1.8	J	0.01	UJ
001L	1	Mud Pit P-5	120		3		2.2	J	0.01	U
001L	4	WIPP-12	18		2		1.4	J	0.01	U
001n	1	Mud Pit P-15	13		4		1.2		0.01	UJ
001n	2	Mud Pit P-15	12		4		1.3		0.01	UJ
001t	1	IMC-374	10		4		1.5		0.01	UJ
001t	4	IMC-374	9.3		3		1.2		0.01	UJ
001h	1	H-15	21		4		2.8	J	0.015	U
001h	2	H-15	27		5		2.4	J	0.015	U
001h	1	Mud Pit P-2	19		6		2.1		0.015	U
001x	1	WIPP-13	10		3		1.6		0.015	U
001x	2	WIPP-13	13		6		1.3		0.015	U
001j	3	Mud Pit P-3	17		26		1.5		0.03	
001j	4	Mud Pit P-3	16		4		1.9		0.015	U
001k	1	Mud Pit P-4	14	J	4	J	1.5		0.015	U
001k	2	Mud Pit P-4	15	J	4	J	1.4		0.06	
001m	1	Mud Pit P-6	11	J	1	UJ	1.3		0.015	U
001m	2	Mud Pit P-6	20	J	6	J	5.1		0.015	U
001s	1	ERDA-9	110	J	4	J	1.9		0.015	U
001s	2	ERDA-9	24	J	4	J	1.5		0.03	
004a	5	Portacamp	14		2		1.4		0.015	U
007b	1	SW Evaporation Pond	11		3		2.5	U		
001g	1	H-14	26		7		2.7	J	0.01	UJ
001g	1	Mud Pit P-1	52		2		3.8	J	0.04	
001g	2	Mud Pit P-1	34		7		5.4	J	0.01	UJ
001L	1	Mud Pit P-5	62		4		3.6	J	0.03	
001L	4	WIPP-12	36		4		1.8	J	0.01	U
001n	1	Mud Pit P-15	16		5		1.4		0.01	UJ
001n	2	Mud Pit P-15	19		4		1.6		0.01	UJ
001t	1	IMC-374	15		5		1.6		0.01	UJ
001t	4	IMC-374	20		1	U	1.4	J	0.01	UJ
001h	1	H-15	33		5		2.9	J	0.03	
001h	2	H-15	170		5		2.2	J	0.015	U
001h	1	Mud Pit P-2	28		6		2.6		0.015	U
001x	1	WIPP-13	12		4		1.5		0.015	U
001x	2	WIPP-13	17		3		1.7		0.015	U
001j	3	Mud Pit P-3	20		5		2		0.015	U
001j	4	Mud Pit P-3	33		4		2.3		0.015	U
001k	1	Mud Pit P-4	18	J	4	J	1.6		0.015	U
001k	2	Mud Pit P-4	19	J	4	J	1.4		0.015	U
001m	1	Mud Pit P-6	10	J	4	J	1.2		0.015	U
001m	2	Mud Pit P-6	19	J	4	J	1.8		0.015	U
001s	1	ERDA-9	15		4		1.8		0.015	U
001s	2	ERDA-9	39		4		2.2		0.015	U
004a	5	Portacamp	14		4		1.5		0.015	U

	Barium		Chromium		Lead		Mercury	
Summary Statistics								
Maximum Value	170		26		5.4	J	0.06	
Minimum Value	9.3		1		1.2		0.01	U
Average	28		4.5		2.02		0.02	
Geometric Mean	22		3.9		1.88		0.01	
Standard Deviation	31		3.5		0.91		0.01	
Number of Values	47		47		47		46	
Background Statistics								
>50% Non Detect:	No		No		No		Yes	
Normally Distributed	No		No		No		No	
Lognormally Distributed	No		No		No		No	
Rec. Bkg. Statistic	NPUTL		NPUTL		NPUTL		NPUTL	
Rec. Bkg. Value	170		26		5.4		0.06	
Carlsbad Background Value	500		50		<10		0.051	
Western U.S. Background Value	580		41		17		0.046	

*NPUTL = Nonparametric upper tolerance limit
Concentrations reported as milligrams per kilogram
J = Estimated Value
Rec. Bkg. Statistic = Recommended background statistic
U = Not detected
References for Carlsbad and Western U.S. Background Values (USGS, 1984)

APPENDIX B - THALLIUM SAMPLING AND ANALYSIS RESULTS

1.0 INTRODUCTION

As part of voluntary investigation activities at the Waste Isolation Pilot Plant (WIPP), soil samples were collected at five solid waste management units (SWMUs) and analyzed for thallium. This Appendix B to the WIPP Sampling and Analysis Plan (SAP) for SWMUs, describes the sampling and analysis program.

2.0 REGULATORY BACKGROUND

In the draft Technical Support Document, Exclusion/Inclusion of Solid Waste Management Units and Areas of Concern, Permit Module VII Corrective Action for Solid Waste Management Units (TSD), the New Mexico Environment Department (NMED, 1999) identified five SWMUs where:

> This SWMU could have been granted NFA if DOE had chosen to resample for thallium using an appropriate analytical technique to demonstrate that no release had occurred.

The five SWMUs were identified as:

- 001k (P-4 mud pit)
- 001m (P-6 mud pit)
- 001n (P-15 mud pit)
- 001s (ERDA-9 mud pit)
- 001t (IMC-374 mud pit)

3.0 SAMPLING AND ANALYSIS PROGRAM

In response to the draft TSD, WIPP performed soil sampling and analysis for thallium at the 5 SWMUs listed above, during September 1999. As part of the sampling program, WIPP collected 42 investigative samples at the same locations and same depths as in the Voluntary Release Assessment (VRA) program (DOE/WIPP 96-2209). In addition, ten associated QA/QC samples were collected as part of the sampling.

The 52 field samples were analyzed for thallium using Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS); Method AS-6-R06 (Equivalent to EPA SW-846 Method 6020; EPA, 1997). The validated analytical results are presented in Table B.1 on a dry weight basis. Overall, thallium was not detected in 51 of the 52 samples. The single detection occurred at SWMU 001s in a sample collected outside the mud pit.

4.0 DISCUSSION

The results presented in Table B.1 demonstrate that no release of thallium occurred at the five SWMUs. Based on these results, no additional sampling is proposed in the SAP for these SWMUs.

In addition, the five SWMUs sampled in September 1999 represent a statistically significant subset of the 11 SWMUs sampled during the VRA. Because thallium was not detected in any of the sampled SWMUs, and thallium has not been identified as a constituent in any material used at any SWMU or area of concern (AOC), thallium will be eliminated as a constituent of concern for all SWMUs and AOCs as part of the SAP.

5.0 REFERENCES

DOE/WIPP 96-2209. Final Voluntary Release Assessment/Corrective Action Report, Waste Isolation Pilot Plant, Carlsbad, New Mexico, November.

New Mexico Environment Department, 1999. Technical Support Document, Exclusion/Inclusion of Solid Waste Management Units and Areas of Concern, Proposed Final Permit Module VII Corrective Action for Solid Waste Management Units. Waste Isolation Pilot Plant, EPA No. NM4890139088, June.

U.S. Environmental Protection Agency. 1997. Test Methods for Evaluating Solid Waste, Office of Solid Waste and Emergency Response SW-846, December. (Incorporating earlier revisions dated 1986, 1992, and 1994).

TABLE B.1 - THALLIUM SAMPLING AND ANALYSIS RESULTS

SWMU	Hole	Depth, in.	Comment	Result, ppmw
001k	Rinseate	NA	Blank	<1.1 U
	1	20		<0.10 U
	1	60 to 66		<0.10 U
	2	23		<0.10 U
	2	60 to 64		<0.11 U
	3	24		<0.10 U
	3	60 to 66		<0.11 U
	4	23		<0.10 U
	4	62 to 68		<0.11 U
001m	Rinseate	NA	Blank	<1.1 U
	1	20		<0.10 U
	1	60 to 66		<0.10 U
	2	20		<0.10 U
	2	62 to 68		<0.10 U
	3	16		<0.10 U
	3	16	Duplicate	<0.10 U
	3	48	Caliche @48 in.	<0.10 U
	4	22		<0.10 U
	4	60 to 66		<0.10 U
001n	Rinseate	NA	Blank	<1.1 U
	1	18		<0.10 U
	1	60 to 72		<0.11 U
	2	20		<0.10 U
	2	60 to 66		<0.10 U
	3	24		<0.10 U
	3	24	Duplicate	<0.10 U
	3	62 to 68		<0.10 U
	3	62 to 68	Duplicate	<0.10 U
	4	22		<0.10 U
	4	60 to 66		<0.10 U
001s	Rinseate	NA	Blank	<1.1 U
	1	23		<0.10 U
	1	66 to 72		<0.11 U
	2	24		<0.10 U
	2	61 to 67		0.13
	3	22		<0.10 U
	3	65 to 71		<0.11 U

SWMU	Hole	Depth, in.	Comment	Result, ppmw
	4	23		<0.10 U
	4	62 to 68		<0.11 U
001t	Rinseate	NA	Blank	<1.1 U
	1	20		<0.10 U
	1	20	Duplicate	<0.10 U
	1	64 to 70		<0.11 U
	2	23		<0.10 U
	2	60 to 66		<0.11 U
	3	17		<0.10 U
	3	60 to 66		<0.10 U
	4	20		<0.10 U
	4	66 to 72		<0.10 U
	5	20		<0.10 U
	5	20	Duplicate	<0.10 U
	5	60 to 66		<0.10 U

Hole = Sample location, see figures in Sampling and Analysis Plan
Depth = Approximate depth of soil sample, inches below ground surface
Rinseate = Equipment rinse blank
Duplicate = Duplicate sample for a given hole and depth
ppmw = parts per million, on a dry weight basis
in. = inch
U = The compound was not detected, at the reported analytical detection limit